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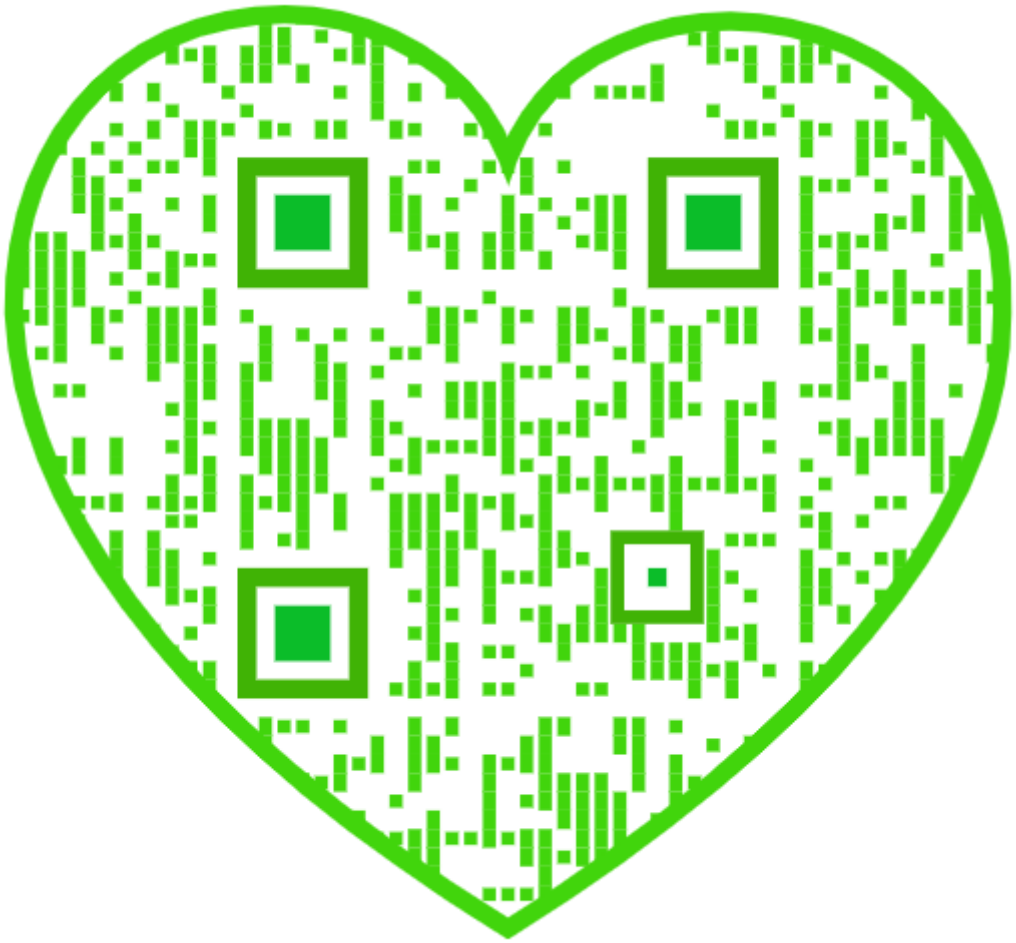
COTTON

GEORGE BIGWOOD

STAPLE TRADES
AND INDUSTRIES



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STAPLE TRADES AND INDUSTRIES
EDITED BY GORDON D. KNOX
Vol. II.

COTTON

GEORGE BIGWOOD

COTTON BOLLS. [*Frontispiece.*

STAPLE TRADES AND INDUSTRIES
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Vol. II.

COTTON

BY

GEORGE BIGWOOD

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PREFACE

In the following pages I have made a modest attempt briefly to trace the beginnings of the cotton industry from the earliest times down to the present day; to describe the remarkable inventions which from time to time were introduced to the industry and which led to its enormous development, and to mention some of the more serious difficulties which confront those engaged in cotton manufacture at the present time.

My aim has been to treat the subject in a popular way, and to avoid technicalities.

For facts and figures concerning the early history of the plant I have consulted the classical writers. For a much later period I have been guided by Baines through his standard work, "The History of Cotton Manufacture." I have also been greatly assisted by the writings of the late Mr. John Mortimer on the process of spinning and weaving, and the Reports of the International Cotton Congresses have proved invaluable in relation to the multifarious difficulties and anxieties which attend this great industry to-day.

This preface would be incomplete were I to omit mention of the debt I owe to Mr. Charles Stewart,

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for permission to reproduce in an Appendix his treatise on "Cotton Futures," and further I must acknowledge my great indebtedness to the Fine Cotton Spinners and Doublers' Association, Ltd., for photographs of the latest cotton spinning machinery ; to Sir Herbert Dixon, Bart., Chairman of the Fine Cotton Spinners' Association and Chairman of the Cotton Control Board, for the plate showing the boll weevil at work and for kindly reading my proofs; to Messrs. Henry Bannerman & Sons, Ltd., for the photographs of "Cotton Bolls"; to Dr. W. Lawrence Balls, formerly Botanist to the Khedivial Agricultural Society of Cairo, and to the Egyptian Government Agricultural Department for the photograph of the flower of the cotton plant; to Professor John A. Todd, of the University College, Nottingham, author of "The World's Cotton Crops," for some valuable suggestions, and to Mr. Arno Pearse for photographs taken in the cotton fields.

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COTTON

CHAPTER I

HISTORY OF THE COTTON PLANT

Long before the dawn of history the cotton plant was cultivated in various parts of the world and the earliest records of the processes of spinning its fleecy "bolls of wool" into yarn and of weaving that yarn into clothing, are of such antiquity as to make it difficult to obtain satisfactory evidence of their beginnings. According to the Sacred Books of the East cotton was in use many centuries before the Christian era, and Virgil in his Georgics refers to

"The groves of the Ethiopians, hoary with soft wool."

قطن

The name "cotton" is of Oriental origin, being derived from the Arabic *koton* or *gootn*. The development in the cultivation of this plant, mainly for the purpose of clothing the people of the world, is one of the romances of modern times. The world's fields now produce cotton of an annual value of hundreds of millions of pounds sterling, and millions of people get their livelihood in the

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production and manufacture of a commodity which, it is estimated, provides clothing for nine-tenths of the world's population.

We do not know whether the need for a thread led to its invention or whether the accidental discovery of the possibility of its construction created the need. Matters such as these belong to a dim and undefinable past. In either case, however, spinning is mentioned in many mythologies, and the forming of threads by drawing out and twisting various fibres, is said to have been a gift to mortals from benevolent deities, Minerva being among the goddesses by whom this gift is understood to have been bestowed.

Over three thousand years ago the cotton plant was used in Egypt as an ornamental shrub. Writing about 306 B.C., Theophrastus, the disciple of Aristotle, describes the flower of the cotton plant as resembling a "dog" rose, and mentions the use made, by the Indians, of the capsules of a downy, silvery substance which bursts open some two months after the flowers have reached maturity. He observes that "the trees from which they (the Indians) make their clothes have leaves like those of the mulberry. . . . They set them in the plains in rows so as to look like vines at a distance." This evidence, from a quite independent observer, seems to point to the interesting fact that the

Indians, in these early days, were cultivating the plant on a large scale to provide cotton cloths for their people. It suggests that weaving and dyeing flourished, and, in all probability, coloured goods were exported. Theophrastus also mentions the island of Tylos as " containing many wool-bearing trees, from the fruits of which they obtained the wool which they worked into textiles." Aristobulus, one of Alexander's generals, and Pliny had found wool-bearing trees in an island on the Persian Gulf " that bear fruit like gourds in shape and as big as quinces which, when they be full ripe, do open and show certain balls within of down; whereof they make fine and costly linen cloths." Herodotus, the Greek philosopher and the Father of History, also mentions the cotton plant, and notes that the Indians possess a kind of " plant which, instead of fruit, produces wool of a finer and better quality than that of sheep; of this they make their clothes."

Of the customs and usages in Egypt, Herodotus says: " Amongst them the women attend markets and traffic, but the men stay at home and weave. Other nations, in weaving throw the wool upwards; the Egyptians downwards." Again, Herodotus describes the corselet which Amasis, King of Egypt, sent to the Lacedæmonians as a present. " This corselet was made of linen, with many

figures of animals inwrought, and adorned with gold and cotton wool." He does not, however, mention the existence, in Egypt, of the cotton plant. It used to be said that Egyptian mummies were wrapped in cotton cloth, but a microscopic examination has decided in favour of the employment of linen which is now known to have been used through successive dynasties. Some Egyptologists are of opinion that the trilingual Rosetta stone, now in the British Museum, that eulogises Ptolemy Epiphanes (about 196 B.C.), refers in part to cotton.

In China, the original home of silk manufactures, the silkworm has been specially cared for from the 23rd century B.C., and the silken threads have been woven into materials which for their workmanship and richness of design have never been surpassed. The cotton-plant, though not indigenous, was employed as early as the 7th century, to assist in the decoration of Chinese gardens, and some authorities assert that its introduction into that country as a commercial venture was as late as the 11th century, and that it came from Eastern Turkestan. Cotton now ranks in China as one of the products necessary for the comfort of their people, and it is extensively grown in the Chiang basin, Nanking being the centre for the cotton used for nankeen cloth.

FLOWER OF COTTON PLANT.

The so-called wool-bearing cotton plant is the subject of a curiously interesting myth which seems to have originated among the savage and nomadic Scythians. The Scythians traded in cotton goods, and the soft white wool of the cotton plant, which resembled that of a lamb, caused them to declare that the plant produced a small lamb, which was called at that early period " The Scythian Lamb," and later, " The Vegetable Lamb of Tartary," or " The Tartarian Lamb." It is hardly likely that those who were trading in cotton goods were so easily deceived, but the close resemblance between the cotton wool and lambs' wool may have encouraged the merchants to invent the " lamb-bearing tree " story in order the better to influence their markets to their own advantage. It is not inconceivable that unscrupulous merchants of the class who travelled from market to market would contrive to place a fictitious value on the fleeces they had to sell, by claiming that they were the fleeces of lambs which were growing on trees in a distant part of the world.

The utility of the cotton plant in providing material to clothe mankind did not in some countries readily suggest itself. There can be no question, however, that its potential value in commerce was discovered at a very remote period. Credit for the discovery is given to the Indians.

Cotton is thought to have been in use by the Indian artisan as early as 800 B.C., while it is conjectured that about three hundred years later the Egyptians had learned something of the character and usefulness of the plant which had previously been growing promiscuously, but not extensively, in their country.

As regards the New World there is substantial evidence that cotton was growing wild in America before the time of Columbus, and that when Cortes conquered Mexico, in 1519, the Mexicans were wearing cotton garments. This goes to prove that cotton manufacture had by then been firmly established by the Mexicans.

The starting point of textile history in this country seems to date from the establishment of Flemish weavers in Manchester, A.D. 1363. In the Manchester Town Hall there is a series of mural paintings by Ford Madox Brown, representing some prominent phases in the early history of the city. One of these pictures is intended to commemorate the foundation of Lancashire supremacy in textile manufacture. Edward III. and his wife, Queen Philippa of Hainault, are said to have advised the introduction of Flemish weavers into England, and tradition mentions yearly visits which it was the Queen's custom to pay them. The artist depicts the Queen riding on her palfrey

and accompanied by attendants carrying branches of May blossoms, for according to the old English custom, they have been in the woods "maying." To the right of the picture an old weaver is seated beside his apprentice at his loom, which is drawn out to the front of their small shop, under the shutters, raised pent-house fashion. There is little doubt that the Royal favour did encourage the weaving industry in Manchester. Some credit, too, is due to Lord de la Warre, a baron of Manchester who, having raised a company of Lancashire men to attend him in the war in Flanders, contrived, on his return, to bring back some weavers with him, and thereby gave an impulse to manufacture. A considerable trade, however, seems to have been done during the reign of Edward II., for there is said to have existed a mill for dyeing goods on the banks of the Irk, once a clear stream noted for its fish, but now hopelessly contaminated by industrial refuse.

The product of the Flemish weavers was called Manchester "stuffs" or Manchester "cottons," though from an Act passed in the reign of Edward VI. (1552), it appears that no "vegetable wool" was used in their production. This Act was intended to secure "the true making of woollen cloth" and regulated the dimensions of "Man-

chester, Lancashire and Cheshire cottons," and Manchester rugs or friezes.

The merchants of those days had warehouses of wood and plaster, and carried their goods to market on pack-horses. They used to be in their warehouses before six o'clock in the morning, accompanied by children of their own family and apprentices. At seven o'clock they had their breakfast, the meal consisting of one large dish of oatmeal porridge. At the side of the oatmeal was a basin of milk, and into these two vessels each one dipped with a wooden spoon, returning to work immediately the porridge was finished.

It is not possible definitely to say at what period cotton was first brought to the Lancashire districts now famed for their cotton manufacture. One historian states that in the year 1635, England began to be an important cotton manufacturing country. According to another view, cotton was shipped to Liverpool in the year 1757. In any case except for candle-wicks, cotton was not employed in England long before the year 1641, when it was used at Manchester for making fustians and dimities. The earlier-mentioned "cottons" were made wholly of wool.

The first recorded consignment of American cotton to Liverpool was in 1784. It consisted of eight bales, and the Custom-house officials

promptly seized it. The reason for this action is not clear, but the officials may have suspected the contents of the bales. One explanation offered is that they thought the cotton had come from a country other than America. Ultimately, this (in the light of to-day) insignificant quantity of cotton was released. In the year 1785 only five bales reached the Mersey port, and six bales in 1786.

Several countries claim the honour of having introduced to Europe the industries of spinning and weaving, but it is practically certain that the followers of Mahomet were among the first to extend those industries to the West. In the Middle Ages the Arabs greatly stimulated cotton cultivation. Later, in Egypt, in 1820 Mohammed Ali interested himself in the cotton trade enterprise, but till then there was no serious attempt to cultivate the cotton plant, and even for three further decades the export of cotton from that country was insignificant. Abbas Pasha (1850) gave greater freedom to the fellaheen in the matter of cotton export, and a few years later the Egyptians exported some 680,000 cantars. (A cantar is about 99 lbs.) This was the largest consignment of cotton that, up to that time, had been sent out of the country. England's share of it was 60 per cent., France and Austria were also buyers. It was during the reign

of Mohammed Ali, that England received her first consignment of Egyptian cotton, but both in quality as well as in quantity it was of little account when considered in the light of modern requirements and modern inventions.

When the International Federation of Master Cotton Spinners and Manufacturers' Associations (formed in 1904) held its Annual Congress in Barcelona, in 1911, Señor Calvet, who represented Spain on the International Committee, reminded the Congress that three hundred years before, Spain was the centre of the European cotton industry, but the King of Spain, at a reception he gave to the International Committee at the Royal Palace, Madrid, observed that he feared his country would never again occupy the position it once held in the cotton industry. When, in 1909, the International Committee visited the Quirinal at Rome, and were received by King Victor Emmanuel, the King, in welcoming the delegates, said that cotton was at one time extensively grown in the districts surrounding Rome as well as in Southern Italy.

CHAPTER II

THE DEVELOPMENT OF SPINNING

The loaded distaff in the left hand placed,
With spongy coils of snow-white wool was graced
From these the right hand lengthy fibres drew,
Which into thread 'neath nimble fingers grew.
At intervals a gentle touch was given,
By which the twirling whorl was onward driven ;
Then, when the sinking spindle reached the ground,
The recent thread around the spire was wound,
Until the clasp within the nipping cleft
Held fast the newly-finished length of weft.

CATULLUS.

MINERVA, as I have already said, was by the ancients regarded as the goddess of the art of spinning, and Catullus is among the poets to sing its praises. Up to the middle of the 18th century the simplest devices were used for twisting the fibres and there was, during this time, apparently no demand for anything more elaborate or calculated to facilitate the work of spinning. It was not a progressive time, or an art so widely practised would have called for the employment of greatly improved methods. From the middle of the 18th century, the inventive mind set itself the task of

revolutionising the spinning processes, and by constant application to the work in hand, the product of the hand-loom was slightly increased through the agency of mechanical means. Experiments with more ambitious mechanical devices followed, and some of these satisfactorily met the claims advanced in their favour by their respective inventors. But the opposition of the workers had to be encountered. They offered the strongest resistance to any modernising of an art which had come down to them through successive generations and, in their view, it was something in the nature of sacrilege to supplant hand-spinning by mechanical means. But the conservatism of the humble operatives had to give way to the advancing tide of commercialism. On the horizon far-seeing men could discern great markets for cotton garments, and it was necessary for the supply of yarn to be increased a hundred-fold to meet the demand of those markets. Hence we have, to-day, machinery of a wonderful range and variety, performing the most delicate of operations and producing cotton cloths with a texture almost as fine as silk—machinery which is the wonder of cotton manufacture.

The distaff and the spindle about which Catullus sang were used exclusively by women. The distaff was a cleft stick about three feet long on which wool or carded cotton was wound. It was held under

Photo by] CASHMERE WOMAN SPINNING COTTON YARN. [*Bremner & Co., Lahore.*

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the left arm, and the fibres of the cotton drawn from it were twisted spirally by the forefinger and thumb of the right hand. The thread, as it was spun, was wound on a reel which was suspended from, and revolved with, the thread during spinning. The word "distaff," was at one time commonly used to symbolise the work or activities of women, a meaning comparable with that of the word "spinster" to-day as applying to an unmarried woman. Formerly, a woman whose occupation was spinning was called a spinster, but since men have largely supplanted women in the work of spinning in consequence of the introduction of machinery, the word "spinster" in its relation to the cotton industry has become obsolete.

There has been some speculation as to how and by whom the process of spinning came to be conceived. It has been suggested that the first spinner was a shepherd-boy, and the material used a few locks of wool. During the idle hours he spent in the fields with his flock, this hypothetical shepherd-boy might have amused himself with a portion of the wool lying near at hand, and quite unconsciously, have twisted its fibres round his fingers, and in the course of time made a thread much longer than the original fibre in much the same way as children make a string of flowers.

It is an interesting and fanciful picture, but it is not unlikely that the beginning of spinning originated in some such simple manner.

The distaff was displaced by the hand wheel and thereby production was greatly facilitated. What was known as the Jersey wheel was introduced and adopted toward the close of the 15th century, and the beginning of the next century marks the period when Lancashire came to be known as a spinning centre. Lancashire had already gained a reputation for wool spinning, and the new hand wheel was used for spinning both wool and cotton. The hand spinning was, of necessity, of an intermittent character, and the inventive mind was at work trying to remedy this by giving a continuous rotation to the spindle. This mechanical improvement was found in the Brunswick wheel which was worked by means of a treadle.

A further important development in this direction was found in the Saxony wheel. This wheel could be fitted with two spindles, so that two threads could be spun simultaneously. The chief feature of this machine was that the bobbin lagged behind what was technically known as the "flyer," which had an independent movement, the spindle giving the twist to the yarn, and the difference of speed of the spindle and bobbin causing the bobbin to be wound. This device

was invented at Nuremberg, in 1530, and embodies the vital principle of Arkwright's (1769) invention.

The machinery was rude in structure and slow in operation until the 18th century. The cotton industry promised to grow enormously, but entirely new methods, it was recognised, would have to be brought into use if that promise was to be fulfilled, and the most important vegetable fibre in the world used to the fullest advantage. The cotton spinner was not then, as now, working in a large factory with machinery kept running during specified hours. The cottage and the farmhouse were the spinning mill and the weaving shed, and wages being high in proportion to the price of foodstuffs, each spinner suited her hours of labour at the wheel to her own convenience. Consequently the spinner was not able satisfactorily to supply the requirements of the weaver, notwithstanding that there were also supplies of yarn from abroad. To the question of supply and demand the woman at the wheel was serenely indifferent. Her primary consideration in regard to the number of revolutions of the wheel was the amount of money required to meet the rent of the agricultural holding or cottage.

It will be interesting here to note how closely allied in the 17th century were the two great industries—agriculture and cotton. Farms were,

for the most part, concerned with the production of milk, butter and cheese, and in the growing of oats which were employed in making meal suitable for porridge and cakes for domestic consumption. Generally speaking, the farming was of that kind which did not call for any attention on the part of an expert agriculturist. The work was done by the members of the family. Whilst the husband and the sons worked in the fields, the wife and daughters attended to the churning and cheese-making, and when these duties were done they turned to "carding" and "slubbing" and the spinning of cotton or wool, and prepared it for the loom. The number of looms in a house varied with the size of the family, and when the rent of the farm could not be raised from the agricultural side of the family's employments, the profits made on the manufacturing side were drawn upon to make up the deficiency.

In the district of Manchester, few farmers raised the rent of their holdings directly from the produce of the field. As Mr. William Radcliffe, an early inventor of textile machinery, has said, the great sheet anchor of all cottages and small farms was the labour attached to the hand wheel. It required six or eight "hands" to prepare and spin yarn of any of the three materials (wool, linen or cotton) sufficient for the consumption of one weaver, so that

labour was thus provided for every person, from the age of ten to eighty years (provided their sight was good and the free use of their hands was unimpaired) to keep them above the poverty line.

A serious hindrance to the development of the trade at this early period was the wide separation of the allied branches. To convert the raw cotton into the finished commodity was a long and tedious business. The cotton wool was shipped from the East Indies to London (Liverpool was not then the great cotton port). It was sent from London to Manchester where it was turned into yarn. The Manchester merchants sent it to Paisley to be woven; it then went to Ayrshire to be tamboured, and returned to Paisley to be veined. It was hand-sewed at Dumbarton, and returning again to Paisley was later sent to Renfrew for the process of bleaching. The Paisley merchants handled it again and sent it on to Glasgow for the final process, and it was then despatched by coach to London. It was calculated that the time occupied in bringing the article to market in its finished state was three years. It must have been conveyed some 5,000 miles by sea and about 920 by land; and contributed to support not less than 150 persons, by whom the value had been increased 2,000 per cent.

The Jacquard machine, which is named after its inventor and soon proved its value, made the

transition between old and new methods, though, as we shall see later; Jacquard was preceded by other equally important and notable inventors. Jacquard was at one time a straw hat manufacturer. His attention had not been turned to mechanical inventions until the Peace of Amiens again opened up the communication of France with England. It appears that an English newspaper fell into Jacquard's hands in which it was stated that an English company was offering a premium to any man who could weave a net by machinery. Jacquard turned his thoughts to the subject and did eventually produce a net. But not altogether satisfied with his work he threw it aside, and later gave it to a friend as a thing of little worth. By some means the net passed into the hands of the authorities, and was sent to Paris. Some time later Jacquard was sent for by the Prefect, who said, "You have directed your attention to the making of nets by machinery?" Jacquard did not immediately admit it, and the net was produced. The Prefect then said, "I require you to make the machine which led to this result." The inventor asked for sufficient time for the work. He was granted three weeks, and at the end of that time he brought the machine to the Prefect, who pressed a lever with his foot and a knot was added to the net. The machine was sent to Paris and

Jacquard was arrested. When under arrest he was taken before Bonaparte and Carnot. Bonaparte said to him: "Are you the man who pretends to do that which God Almighty cannot do—tie a knot in a stretched string?" Jacquard replied by producing the machine and showing how it was worked. He was afterwards called to examine a loom on which twenty or thirty thousand francs had been expended for the production of articles for the use of Bonaparte. A little later he made the machine which bears his name and returned to his native town with a pension. But he suffered great persecution in consequence of his invention and his life was in danger. His machine was broken up, and the iron (to use his own expression) was sold for iron, and the wood for wood, and Jacquard was made to suffer universal ignominy. It was only when the French manufacturers complained of foreign competition that they turned to his machine and, through its use, saved the situation. Jacquard, their saviour, had trodden the hard path of many inventors.

CHAPTER III

THE COTTON FIELDS

And lo !
To the remotest point of sight,
Although I gaze upon no waste of snow,
The endless field is white ;
And the noble landscape glows,
For many a shining league away,
With such accumulated light
As Polar lands would flash beneath a tropic day !

HENRY TIMROD.

THE many uses to which the cotton fibre is now applied have enormously enhanced its commercial value, and strengthened the demand for its increased cultivation. It is computed that nine-tenths of the clothing of the inhabitants of the world is made of cotton, and that out of a population of 1,500,000,000, only 500,000,000 are completely clothed, 750,000,000 are only partially clothed, and that 250,000,000 are without clothing of any description.

To regard cotton only as the raw material for the clothing of mankind would be a serious misconception. The bulk of the world's cotton crop is

used for this purpose, but its employment does not now end here. The introduction of mechanical appliances has greatly extended the utility of the fibre, and to-day we cannot overlook or ignore its application to science and to the arts, and other interests foreign to the cotton industry, in the narrower sense of the manufacture of cotton clothing. Chemically treated, cotton is a powerful explosive; mechanically treated, it is a highly inflammable material. It is used on the battlefield as a destroying agent; it is to be found there among the healing agencies. Aircraft, for its structure, draws upon the best qualities of cotton, and steam has not altogether displaced it in our sailing craft. Cotton is extensively used in medicine and surgery; the imagination of the artist is revealed upon it; it is indispensable to the motor manufacturer; it is used as a covering for our electric and telephone wires; our homes are largely furnished with it. Cotton is a very adaptable material, and therefore a commodity of the greatest value, and the trade in it has reached gigantic dimensions.

It will be interesting in this and subsequent chapters briefly to trace this remarkable growth; to take a comprehensive view of the industry. Let us, in imagination, go to the extensive American cotton fields and learn something of the work of

the planter, and of the system of intensive culture which is pursued there both to improve the cotton staple and to increase the yield. We will then attempt to widen our knowledge in regard to the care bestowed on the plant until the flower and the "fruit" (bolls of cotton) in their season reach maturity; try to appreciate the care which has to be exercised in gathering the cotton, and follow the work of ginning and baling that is preparatory to its shipment to the cotton-manufacturing countries. Then we might conveniently turn to the manufacturing side and trace the development of mechanical inventions for spinning and weaving; discuss the urgent need for widening the field of cotton culture in the British Empire, and deal with other matters which so closely affect the future welfare of the industry.

Not one pound of cotton is, or can be, grown in these islands, for the plant is extremely sensitive to weather conditions. It cannot thrive in our cold and variable climate. It flourishes only in tropical or semi-tropical countries. On the other hand the manufacture of the raw cotton into the finished article can best be done in a district where there is an abundance of moisture. This may, in part, explain the establishment and remarkable growth of the spinning industry in Lancashire, for that county has gained an unenviable reputation for an

excessive rainfall. In the cotton-growing areas of the world the climate is not constant. Seed-time and harvest come at their appointed seasons, but an abnormal rainfall or an extended period of drought will seriously affect the crop alike in quality and in quantity. Either of these contingencies might arise after the size of the crop has been estimated, and extensive operations have taken place in the cotton markets of the world on the assumption that its development would proceed unchecked. This explains the eagerness with which the meteorological reports are awaited at the Exchanges where " merchants most do congregate " in this country and on the Continent. A damaged cotton crop brings disaster to the planter, great anxiety to the spinner and manufacturer who are called upon to pay higher prices for the raw material, and distress to the millions of operatives who depend upon a good supply of cotton reaching the mills.

The cotton-producing region of the United States of America stretches 500 miles from north to south and 1,500 miles from east to west—a territory of 750,000 square miles, and includes the States of Alabama, North and South Carolina, Louisiana, Mississippi, Kansas, Oklahoma, Texas, Florida, Georgia, Tennesse and Indian Territory. Ideal conditions for the successful cultivation of the

cotton plant are a soil of fine sandy loam, a proportionately high and even temperature and humidity, a careful selection of seed, a scientific use of fertilising agents, maximum of sunshine by day and heavy dews by night, frequent light showers shortly after sowing, and an absence of frost.

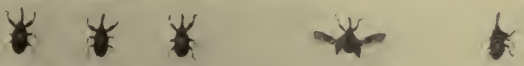
A Lancashire Private Cotton Investigation Commission, in 1906, visited the American cotton fields and reported that there were numerous varieties of temperature, of weather, of humidity, of soil, of labour, of land tenure, of methods of cultivation, and of pests. It was possible for the crop in one district to be a record success; in another a record failure. Drought on the one hand, or excessive rains on the other, might turn a promise of plenty into a reality of scarcity. In the southern portion of the belt, planting might begin in February and not be completed in the northern portion until June. July witnesses the first picking in South Texas; December does not always see it completed in North Texas. It will be readily understood, therefore, that the great cotton fields of America are not likely in any one season to possess all the essential conditions which are laid down as being necessary for a good crop, nor is the quality of the cotton produced in all the areas of the same standard or value.

The preparation of the field for the cultivation of cotton follows much the same lines in all cotton-growing countries. The seed is not now sown by hand. A machine drill is used, and germination takes place very quickly. Ordinarily, about a week or ten days after sowing, the plant appears, and provided its development is not in any way retarded, it will be about four inches high at the end of the first month, when the process of thinning begins. It is now a question of the survival of the fittest. The more progressive farmers arrange the plants so that there shall be a space of three feet dividing each plant and also the rows of plants. This is done in order to secure the maximum amount of sun to assist germination and to enable the ploughing to be done without damage to the crop. The cultivator breaks up the earth between the plants once every three weeks until the flowers appear and the "boll of wool" is formed. Five or six weeks later the cotton is ready for picking, provided the sun and rain — extremely important factors — have favoured cultivation.

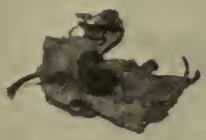
We will assume that the plant has escaped the danger arising from too little or overmuch rain; too great heat or excessive cold, or a heavy and unseasonable fall of rain. But all danger to the life of this sensitive plant has not passed. There are

enemies lying in wait to attack it. An American once said that from the time of planting up to the time of maturity cotton was the constant object of attack. The slightest frost kills it, and an army of "creeping, crawling, boring and flying insects is ever trying to destroy it." The notorious boll weevil pest was first noticed in 1862, in Mexico, and thirty years later it was found in Texas. In 1906 the weevil infested a third of the cotton acreage, and was reported to be within one hundred miles of the Mississippi. During the last decade it has advanced westward at the rate of fifty miles a year. It now infests the whole of the cotton belt and is said to be responsible for reducing the crop one half. The weevil goes on propagating its species as long as the cotton plant is allowed to flower. It then hibernates, reappearing with the first warm days of spring, and flies in search of "volunteer," or wild, cotton plants. From these it migrates to the cultivated crops as soon as they are sufficiently grown to provide food and shelter. The female deposits its eggs as soon as the bolls are formed. As it lays three hundred eggs, and the cycle of life is but fifteen days, its offspring may number hundreds of millions by the end of December.

To allay the ravages of this pest it is recommended



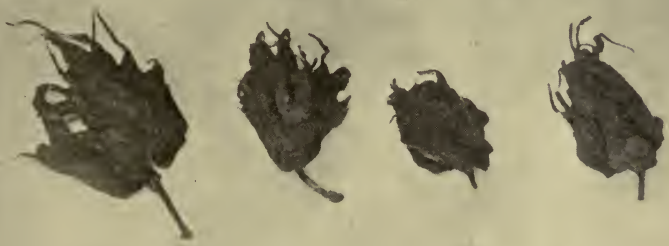
The perfect insect.



The Weevil emerging through the hole which it has eaten in the side of the Pod.

Section of a vacated Pod, showing the interior entirely eaten away.

Diseased Pods showing holes made by the perfect beetle when escaping.



Diseased Pods of the Cotton Plant, after having been attacked by the Boll Weevil.

that early maturing varieties of the cotton seed be planted so as to secure, as far as possible, a uniform flowering crop, instead of one which continues to flower and bring forth fruit throughout the autumn. Further that the cotton stalks and leaves should be burned without waiting to gather the top crop. If these precautions are taken the boll weevil has to stop its destructive operations in July and August, with descendants numbering thousands instead of millions.

Other pests include the boll worm, the cut worm, the cotton worm, and the army worm. The boll worm confines its ravages to the boll, the cut worm attacks the plant in the early stages, the cotton moth produces the caterpillar which devours the leaves, and the army worm invades the cotton area in large armies and devastates whole fields in a comparatively short time.

A ripe field of cotton presents a highly attractive picture. The regulated rows of freely-branching shrubs with their yellow-shaded flowers (not unlike the hollyhock) which have been blooming for months—this is peculiar to malvaceous plants—are now covered with tufts of cotton wool which glisten in the sunshine. Standing a short distance away one can imagine it to be a large field which has been visited by a heavy snowstorm. When the negroes are in the field gathering the pure white,

woolly substance one cannot, at first, resist the feeling that it must be soiled as their hands approach the precious fibre to draw it from the bursting capsule.

The " fields are white unto harvest." Now is the time for the most tedious, the most difficult and the most expensive of all cotton-growing operations—the gathering or picking of the ripe cotton. This is, in the main, the work of negroes, and in this particular instance, machinery has not supplanted hand labour, for although attempts are being made to produce an efficient automatic cotton picker, it has not yet been possible to invent a machine to meet all requirements. The chief difficulty in developing a successful cotton-picking machine is the irregular ripening and opening of the boll. It is hoped that continual cultural research may lead to the development of a cotton plant on which a large percentage of bolls will mature uniformly. If success could be achieved in this direction the urgent demand for a cotton-picking machine would soon be met, because while one man with proper machinery is able to cultivate about twenty acres of cotton, the same man cannot pick more than 200 lbs. of cotton daily. By this slow operation the harvest is delayed, and the expense of harvesting is disproportionately increased. It is calculated that a good picker may gather from

200 to 400 lbs. a day, and the pay ranges from 60 to 100 cents for every 100 lbs. of cotton picked. The work must be done expertly, or serious loss might accrue to the farmer by the breaking of the silken filaments.

Cotton has been called " the black man's crop." For three-quarters of a century before the War of Secession, cotton was cultivated by slave labour. During this period the negro had the whip hanging over him if he neglected his work. After the liberation of slaves, the planter found that, in order to keep the negro at work, he had to " hold him " financially. In the American fields to-day the labour employed is cosmopolitan in character. The negro predominates. Next in point of numbers are the European emigrants, mostly Italians; and Mexicans. Their employment is governed by the system of land cultivation, and on the large plantations uniform conditions do not always obtain. Some of the work is done by hand labour, and some under what is known as the " cotton rent " system and the share system. The latter method is the one most generally employed, and was introduced in order to secure a hold on the negro, whose nomadic peculiarities are not in the interest of successful cotton cultivation. Reports vary as to the value of the negro as a labourer. Some planters give him a good character; many

planters denounce him as an idle, worthless fellow, who must be brought under a rigid discipline if work is to be got out of him. The value of the negro as a labourer will no doubt largely depend on the kind of treatment he receives.

Women are reputed to be better pickers than men, but one professing knowledge of male pickers has made the curious statement "that the small, compact young man, weighing about 140 lbs. and not more than 5 ft. 8 ins. in height, is best adapted for the work."

Cotton picking is a very exacting and monotonous work. Mr. J. B. Lyman, an American, writing on cotton culture, observes that though too much talking and singing must interfere with labour, every cotton grower should take care to secure cheerfulness, if not hilarity, in the field. It should not be forgotten that it is a very severe strain upon the patience and spirits of any one to be urged to rapid labour of precisely the same description day after day, week after week, month after month. To relieve the monotony he recommends the cotton grower to provide in the field a dish of hot coffee for a cool morning or a pail of buttermilk for a hot afternoon, and occasionally a tub of sweetened water or a basket of apples. The harmless jest, too, should be encouraged during the intervals of refreshment, so that when the labour of picking is

Photo by] PICKING COTTON IN THE UNITED STATES. [*J. Banks, Manchester.*

(Notice Sacks hanging over the Backs of Pickers.)

resumed the fingers may be induced to " spring from one snowy boll to another. Hands will not pick any the worse the next day for having danced till ten or eleven o'clock the night before, and among Africans, at least, the best dancer is likely to be the best picker."

When the cotton is picked, it is " ginned " and made up into bales and shipped to the spinning and manufacturing centres. The " seed cotton " (this is the term applied to the cotton before it has undergone the ginning process) must have the seed and other foreign substances removed before it is pressed into bales and sent to the markets.

In India, as far back as the year 800 B.C., the seeds were separated from the fibre by a handmill made of two fluted rollers, arranged horizontally, between which the cotton was passed. This system of cleaning was found to be suitable for long staple cotton, but for the short staple cotton it was not satisfactory. The saw gin, the first commercially successful cotton gin and the prototype of most of the gins now in use, was invented in 1793 by Eli Whitney. This " gin " (an abbreviation of " engine ") is made up of circular saws which, in their revolutions, draw the cotton lint from the seed, and a cylindrical brush removes the cotton to a place where the action of a fan carries on the

cleaning process. In some of the older ginneries horse-power is used, but all the modern machinery is driven by steam or electricity. When ginned and baled, the cotton is ready for shipment to the world's markets.

CHAPTER IV

TRIUMPH OF MECHANICAL INVENTION

As he opened the door, he beheld the form of a maiden
Seated beside her wheel, and the carded wool like a snowdrift
Piled at her knee, her white hands feeding the ravenous spindle,
While with her foot on the treadle she guided the wheel in its motion.

LONGFELLOW.

LONGFELLOW describes a scene which was peculiar to Lancashire and Yorkshire one hundred and fifty years ago. At that remote period the British cotton industry was in its infancy ; it was struggling for its very existence against the bitter opposition of the long-established home industries of wool and linen, and the old prejudice against cotton spinning and the wearing of cotton garments which pervaded the operative weavers and the working classes generally.

Old edicts point to the fact that the weaving of cotton goods was at one time a crime. To bury a dead body in anything but a woollen shroud was declared to be a penal offence, and ladies who wore

cotton dresses were called upon to pay a substantial fine. Weavers of woollen fabrics continued to offer that determined resistance to the introduction of the cotton fibre, until the Legislature, sharing the belief that the spinning of cotton would ruin the then existing industries, passed a statute prohibiting the use of cotton manufacture. A penalty of £5 was imposed upon the weaver and £20 on the seller of a piece of calico. So deep-rooted had become the opposition to cotton fabrics that even criminals on the scaffold pleaded with the people who had gathered to witness the execution, to shun the wearing of cotton.

In the year 1734 there appeared in the *Gentleman's Monthly Intelligencer* the following:— "This day one Michael Carmody was executed for felony; upon which the journeyman weavers (who labour under great difficulties by reason of the deadness of trade, occasioned by the pernicious practice of wearing cottons), assembled in a body, and dressed the criminal, hangman, and gallows in cottons, in order to discourage the wearing thereof; and at the place of execution the criminal made the following remarkable speech:—

"'Give ear, O good people, to the words of a dying sinner. I confess I have been guilty of many crimes that necessity compelled me to commit, which starving condition I was in, I am well assured,

was occasioned by the scarcity of money, that has proceeded from the great discouragement of our woollen manufactures.

"'Therefore, good Christians, consider, that if you go on to suppress your own goods by wearing such cottons as I am now clothed in, you will bring your country into misery, which will consequently swarm with such unhappy malefactors as your present object is; and the blood of every miserable felon that will hang, after this warning from the gallows, will lie at your doors.

"'And if you have any regard for the prayers of an expiring mortal, I beg you will not buy of the hangman the cotton garments that now adorn the gallows, because I can't rest quiet in my grave if *I should see* the very things wore that brought me to misery, thievery, and this untimely end; all which I pray of the gentry to hinder their children and servants for their own characters' sake, though they have no tenderness for their country, because none will hereafter wear cottons, but oyster-women, criminals, hucksters, and common hangmen.'"

Despite this bitter denunciation of the practice of wearing cottons the trade throve, and forty years later our home manufacturers deeply resented the competition created by the importation of beautifully designed cotton fabrics which the

people of the East were sending us. There were restrictions, too, in the form of taxes which impeded the development of the industry. The Government imposed a " fustian " tax by which one penny per yard was exacted on all bleached and dyed cotton manufactures under three shillings per yard, and twopence per yard if exceeding that price. This tax was considered to be a serious hindrance to trade, and representatives of firms employing 38,000 workpeople declared " that they were under the sad necessity of declining their present occupations " until Parliament should again meet to reconsider the position. Eventually, the tax was repealed on the motion of Mr. William Pitt, who was mainly responsible for the imposition of the duty.

In 1788 a meeting was held in Manchester to consider the depression of our cotton manufactures arising from the " immense importation " of Indian goods, and Government assistance was sought. At this time it was calculated that the manufacture of cotton goods employed at their own homes 159,000 men, 90,000 women and 101,000 children.

* * * * *

From the year 1750 men were at work trying to produce a mechanical device which would have the effect of greatly increasing the output. They had their eyes open to the enormous possibilities which the manipulation of the cotton fibre pre-

sented to the industrial world. But the domestic class of spinners and weavers continued to regard with the greatest suspicion any and every "new-fangled" device. Writers of that time questioned whether it would be good policy for a commercial state to make use of machines to lessen the price of labour. The disturbed operatives failed to see that in proportion as the means of production increased new avenues for profitable enterprise and adventure would be opened up.

Persecution, disappointment and sometimes banishment were the trials that accompanied our inventors of cotton machinery and appliances. The flying shuttle was one of the earliest and most notable mechanical contrivances for spinning. John Kay, the inventor, son of a woollen manufacturer of Bury, had spent many years trying to devise means whereby the labour of the weaver might be reduced and the output at the same time increased. In the end he gave to the weaver's shuttle a mechanical impulse entirely displacing the shuttle which up to that time had been thrown backwards across the loom by two operatives. This old shuttle was practically the same as that mentioned in the Book of Job, and used by the Egyptians for the manufacture of linen for mummy wrapping. The fly shuttle soon proved its value, and Kay established a woollen factory at Colchester.

Here the operative weavers declined to have anything to do with his invention and he was eventually driven from the town. Some time later Kay had settled in Leeds where his experience was again distressingly unfortunate. The Yorkshire manufacturers tested the shuttle and saw that it was good. They approved and adopted it, but declined to recognise the claims of the inventor and he was forced to protect his rights in a court of law.

Some of the manufacturers met together and formed a " Shuttle Club," and the avowed purpose of this club was to defraud Kay of his just remuneration. The workpeople too rose against him and by their violence compelled him to close his workshops. Once more a wanderer he returned to his native place at Bury. Even here, the inventor found none to do him honour. A lawless and ignorant mob broke into his house, destroyed everything they found, and would have killed him if, wrapped in a blanket, he had not been conveyed to a place of safety by two friends. About the year 1756, having in vain sought the assistance of the Society of Arts, he fled in disgust from his native town to France. During his stay there in exile the British Ambassador learned of his misfortune. Encouraged by the Ambassador's efforts to gain him some reward from the Government in recognition of his great achievement, Kay

returned to England. But he was again disappointed. Hopelessly crushed in spirit, and apparently quite friendless, Kay returned to Paris, where he died in poverty and obscurity—no stone marking the place where he lies. His daughter, fearing that she too might be the object of scorn, sought refuge in a nunnery.

The increasing demand for fabrics made wholly or partly of cotton, and the greatly increased productive power of the loom following the application of Kay's fly shuttle, led the Society of Arts (1761) to appeal to the inventive minds of the time to devote some attention to improving the old spinning wheel. In the records of the Society it is shown how that having been informed that our manufacturers of woollen, linen and cotton found it exceedingly difficult, when the spinners were out at harvest work, to procure a sufficient number of hands to keep their weavers and other operatives employed, and that for want of proper despatch in this branch of manufacture, the merchants' orders for all sorts of piece goods were often greatly retarded, to the prejudice of the manufacturer, merchant and master in general, the Society decided that an improvement of the spinning wheel would be an object worthy of their notice. Accordingly the Society offered two prizes—one of £50 and one of £25—for the best invention of a machine

that would spin six threads of wool, flax, hemp or cotton at one time and that would require but one person to work and attend it. Cheapness and simplicity in the construction, it was explained, would be considered part of its merit.

Some years earlier, however, an attempt was made to substitute a roller-spinning machine for the hand wheel. The names of Lewis Paul and John C. Wyatt were identified with this effort. It has been stated that the original plan of Wyatt was to employ a pair of rollers for delivering, at any desired speed, a sliver of cotton to the bobbin and fly spindle as in a flax wheel. These roller-spinning efforts were not immediately successful, but the principle involved found practical expression some years later and has been greatly developed in the modern mill. It is also recorded that a Mr. Earnshaw, in 1753, invented a machine to spin and reel cotton at one operation, which he showed to his neighbours, and then destroyed it. This extraordinary action was taken because he feared that he might deprive the poor of bread.

James Hargreaves, the poor weaver of Blackburn, was another of the martyrs of scientific industry. Hargreaves invented the carding machine—an apparatus designed to remove all impurities from the raw cotton—and a few years later (1767) he introduced to the trade the spinning "jenny,"

a word which Dr. Brewer tells us is a corruption of engine ('ginie). It was while working in the weaving shed that Hargreaves conceived the idea of making a machine that would spin several threads at one and the same time. At first the jenny contained eight spindles, and when the spindleage was increased to eighty, its labour-saving capabilities greatly alarmed the workpeople. Hargreaves is said to have received the original idea of his machine from seeing a one-thread wheel overturned upon the floor, when both the wheel and the spindle continued to revolve. The spindle was thus thrown from a horizontal into an upright position; and this suggested to him that if a number of spindles were placed upright and side by side, several threads might be spun at once. Hargreaves pursued this idea, and the specification of his patent said that "the machine is to be managed by one person only, and the wheel or engine will spin, draw and twist sixteen or more threads at one time by a turn or motion of one hand, and a draw of the other."

Hargreaves worked at his invention in secret, for he feared the consequences of revolt among the operatives. In a garret he brought his machine to perfection and from it provided himself with weft for his loom. But he soon fared the fate of Kay. The operatives destroyed his machine, and

he went to Nottingham, where he patented his invention and brought an action against Lancashire manufacturers who were alleged to be infringing his rights. But the defence of the manufacturers was that before leaving Lancashire the patentee sold some of his jennies to provide himself with money to meet his immediate needs. This defence, which could not be rebutted, destroyed his claim to compensation. At Nottingham, Hargreaves became acquainted with a man named James, who declared his intention to become a cotton spinner, and the two built a small mill which was probably the first cotton mill in the world. Hargreaves died in comparative poverty. But his invention lived after him and was extensively used until other and improved appliances displaced it.

Arkwright, whom Carlyle mercilessly describes as " a plain, almost gross, bag-cheeked, pot-bellied Lancashire man, with an air of painful reflection, yet also of copious free digestion," was more successful as an inventor of cotton machinery. " In strapping of razors, in lathering of dusty beards, and the contradictions and confusions attendant thereon, the man had notions in that rough head of his: spindles, shuttles, wheels, and contrivances plying ideally within the same." The story of Arkwright's elevation from a humble and obscure parentage to a position of affluence and distinction is as

remarkable as the evolution of the cotton industry with which in his later years he was so closely identified. Richard Arkwright, the inventor of the power-loom, was the youngest of a family of thirteen children. At an early age he was apprenticed to a Preston barber. His adventurous spirit (in 1760) led him to Bolton, where he established a business of his own. He occupied a cellar (there are many underground shops in Lancashire to-day), and attracted customers by exhibiting on the footpath the following exhortation to passers-by: "Come to the subterranean barber: he shaves for a penny." The Bolton barbers resented this stranger coming among them and cutting both the hair of their customers and the customary price of the trade. They were filled with wrath. But Arkwright was capturing their trade and they, too, had to drop their charges. The subterranean barber reflected. Then he took down his signboard, removed the notice that had caused his rivals so much anxiety and substituted the following:— "Richard Arkwright, Subterranean Barber. A clean shave for a halfpenny."

But Arkwright had other interests far removed from hair-cutting and shaving. He was inclined to mechanical invention—he dreamed of discovering perpetual motion. When this began to take possession of him it is not unlikely that he

neglected his tonsorial connection, and this neglect, it is conjectured, led his wife to imitate the wife of Bernard Palissy, the potter, for one day Arkwright discovered, to his great dismay, that some of his most cherished models had been destroyed. He never forgave his wife for this sacrilegious act and permanent estrangement followed. Arkwright disposed of his shop and travelled the country with a hair dye, a concoction of his own which was in great demand in a period when wigs were the fashion. He was also a familiar figure at the country fairs where he had some success as a dealer in hair which he used for making wigs. It was during this itinerary that the need for an improvement on the hand-spinning wheel asserted itself and largely controlled his thoughts. At this time he lived among the operatives; he learned from them how great was the need for more yarn; questioned them as to their output. By a process of sympathetic enquiry he acquired invaluable information as to the character of the work done, and with a practical insight into the industrial needs of the time, with a remarkable facility for exploiting the ideas of others, and with a secretiveness which goes to prove that unless he proceeded with caution he might share the fate of Kay and Hargreaves, he began the work which was destined to revolutionise cotton manufacture.

Arkwright's machine was an elaboration of the principle introduced by Wyatt of Birmingham, who, in 1730, had been proved to be the inventor of elongated cotton by rollers in the spinning operation. The fibre or short threads of cotton were passed through two distinct sets of rollers, the second set revolving at a more rapid rate than the first. This caused the cotton to be attenuated and to be slightly twisted. A repetition of the process would make a finer thread and a further twist would strengthen it. Arkwright applied this machine most satisfactorily to the production of water twist which was used for warps instead of linen yarn. These inventions of Hargreaves and Arkwright effected an entire change in the manufacture of cotton, wool and flax. The men by whom they were really invented, Paul and Wyatt, did not gain for them the public favour they deserved. Arkwright, with indomitable perseverance and with a mind perhaps equally inventive, won the prize of fortune and fame in which in a large degree the original inventors should have shared.

In order to avoid trouble with the operatives, Arkwright went to Nottingham, where he got his machine patented and worked it by horse-power. Later he entered into partnership with Samuel Need and Jedediah Strutt, and built mills at Crom-

ford and Matlock, where he got his power from the waterwheel. Dr. Darwin, in his "Botanic Garden," attracted by the picturesque setting of these mills on the Derwent—it has been described as "the picturesque period of the cotton factory"—gives the following poetic description of the Derbyshire cotton mills :—

"Where Derwent guides his dusky floods,
Through vaulted mountains and a night of woods,
The nymph Gossypia treads the silver sod,
And warms with rosy smiles the wat'ry God ;
His ponderous oars to slender spindles turns,
And pours o'er massy wheels his foaming urns ;
With playful charms her hoary lover wins,
And wields his tridents while the monarch spins.
First with nice eye, emerging Naiads cull
From leathery pods the vegetable wool ;
With wiry teeth revolving cards release
The tangled knots and smooth the ravelled fleece ;
Next moves the iron hand with fingers fine,
Combs the wide card, and forms th' eternal line ;
Slow with soft lips the whirling can acquires
The tender skeins, and wraps the rising spires :
With quickened pace successive rollers move,
And these retain, and those extend the rove ;
Then fly the spokes, the rapid axles grow,
While slowly circumvolves the labouring wheel below."

Derbyshire is no longer a cotton-spinning centre. Practically the whole industry is concentrated in Lancashire, where everything (even the picturesque) is subordinated to commercialism. "Manchester"

(wrote Carlyle), "with its cotton fuz, its smoke and dust, its tumult and contentious squalor, is hideous to thee? Think not so: a precious substance, beautiful as magic dreams and yet no dream but a reality, lies hidden in that noisome wrappage. . . . Hast thou heard, with sound ears, the awakening of a Manchester, on Monday morning, at half-past five by the clock; the rushing off of its thousand mills, like the boom of an Atlantic tide, ten thousand times ten thousand spools and spindles all set humming there,—it is perhaps, if thou knew it well, sublime as a Niagara, or more so. Cotton-spinning is the clothing of the naked in its result; the triumph of man over matter in its means."

Many manufacturers who used Arkwright's water-frame took advantage of the dispute that arose in respect of its invention to use his machine regardless of the protection which his patent rights afforded. It was alleged that the water frame was not Arwright's invention at all; that he had appropriated the creation of a poor man named Highs. It is not necessary to refer at length to this quarrel beyond stating that Mr. Guest, in his history of cotton manufacture, claims that the entire and undivided invention of the spinning jenny and water frame of which Arkwright and Hargreaves have been called the originators was the work of Highs.

There is evidence to prove that Highs was an inventive genius. At a time when weavers were often idle because of the difficulty of obtaining weft, he set his mind to work to devise a machine which would supply at least enough weft to keep the weavers fully employed. Returning to his home at Leigh, he confided his proposal to a clock-maker named Kay, whom he engaged to make the wheels and other parts of the apparatus of which he had prepared a rough design. The two worked together in a garret at Highs' house, and the Leigh operatives, ridiculing the idea that two of their neighbours should presume to be so gifted, raised derisive cries as they passed to and fro, and would jeeringly make a request for weft. After months of arduous work and in the face of a growing storm of ridicule, Highs was seized with a fit of despondency, and the machine, which with a little more labour might have been brought near to perfection, was thrown out of the window and dashed to pieces. Kay was asked how much money his master had given him for his assistance in the abortive attempt at mechanical construction. With a laugh he asserted that he had done with spinning. He was more successful in making clocks. The fit of rage which had so suddenly and unexpectedly attacked Highs soon passed over. He had suffered defeat in his first attempt, he might be more

Photo by] INDIANS DOUBLING COTTON. *Bremner & Co., Lahore.*

successful if he persevered a second time. Collecting the fragments of his machine he returned to the garret and in time produced a machine which he called a spinning jenny.

But Arkwright steered for himself a successful course in this angry sea of controversy. In 1786, he attained to the position of High Sheriff of Derbyshire, and was knighted in that year by King George III. Arkwright died in 1792 in his sixtieth year. He had presented on two occasions to each of his ten children the sum of £10,000 and he left at his death half a million sterling.

Up to this time the inventive mind had produced machinery that would spin the coarser kind of yarn. It was left to Samuel Crompton (1779) to provide the industry with the famous "mule" (so-called because of its being a cross between Arkwright's machine and Hargreaves' jenny), for spinning the finer cotton fibre. The "mule" is one of the most important inventions in connection with cotton manufacture, thus falsifying the statement of the son of a manufacturer who feared his father's "mules" would turn out to be asses. Crompton was born at Firwood, near Bolton, in 1753. His father was a small farmer who, according to the custom of that period, divided his time between the field of growing crops and carding, spinning and weaving. At the age of sixteen, Samuel

Crompton learned to spin on Hargreaves' jenny, and not satisfied with its work, he decided if possible to improve it. After five years almost constant labour he produced the mule-jenny. The young inventor was at this time living at Hall-i'-th'-Wood, near Bolton-le-Moors. The news that a new machine was about to be introduced to the trade soon spread in the district, and annoyed by importunate visitors, Crompton kept it in his bedroom. But the adoption of this precaution did not place him and his machine out of the reach of his tormentors. They got ladders from adjoining premises and climbed up to the windows to satisfy their curiosity and to cause annoyance. Ultimately some manufacturers paid Crompton £50 for the privilege to inspect his work.

Crompton had set himself the task to produce a finer yarn. Of the labour it involved, he said :— "The next five years had this addition added to my labour as a weaver, occasioned by the imperfect state of cotton spinning ; and though often baffled, I as often renewed the attempt, and at length succeeded to my utmost desire at the expense of every shilling I had in the world."

Crompton's machine was called the Hall-i'-th'-Wood Wheel, or Muslin Wheel, because its capabilities rendered it available for yarn for making muslins ; and finally it got the name of "mule."

Crompton's first suggestion was to introduce a pair of rollers, which by pressure would elongate the rove (attenuated thread). In this he was disappointed, and later he saw the necessity of adopting a second pair of rollers. These rollers were made of wood and covered with sheepskin and are said to have been neither more nor less than a modification of Mr. Arkwright's roller beam. Only twenty spindles were introduced into the "mule," and they required all the skill and talent of its inventor to manage them; but with the mechanical improvement and final perfection of it, the number of spindles allotted to the care of one man with a few children to assist, extended to 200, then to 2,000—and for some yarns to 4,000 spindles. The mule has become almost an automaton, and its self-acting principle has further economised human labour.

The inventor of the mule did not escape the violent attentions of the operatives, and as he could not patent his machine, he gave it to the public on condition that a sum of money was raised for him from among those who intended to make use of it. A sum of under £60 was promised, but many of the promises were not fulfilled. Crompton was denounced as an impostor; as one who endeavoured to make money out of an invention which really belonged to another. But with a sum of £500

(raised principally in Manchester), Crompton started a little spinning business at Bolton, where he "spun the finest and best yarn in the market." With a good supply of muslin yarn the weavers had an exceptionally prosperous time. In 1793, they received four guineas for weaving a piece 24 yards long. "The trade was that of a gentleman. They brought home their work wearing top boots and ruffled shirts, carried a cane and in some instances took a coach." It is also related that many weavers at that time used to walk the streets with a five-pound Bank of England note displayed in their hat bands. They smoked nothing but long churchwarden pipes, and objected to the intrusion of any other handicraftsmen into their particular rooms in the public-houses which they frequented.

Crompton had the mortification of seeing his machine appropriated by men who declined to recognise his claim to any remuneration for the great endowment he had made to the cotton trade. Happily there were a few interested persons who made it their business to see that his merits were not entirely ignored. Parliament was petitioned to make him a grant, and £50,000 was suggested as a reasonable sum to recompense him for his labours. He received only £5,000. It is not unlikely that Crompton would have got a larger sum but for a tragic event in the House of Commons on May 11,

1812, when Mr. Perceval (Prime Minister) was shot. A memorandum concerning a vote for £20,000 was found in Mr. Perceval's possession when he fell. Crompton died in 1827, and thirty years later the inhabitants of Bolton erected a bronze statue to perpetuate his memory.

Dr. Edmund Cartwright, the inventor of the power-loom, was a man of many parts. He was educated at Oxford, where he distinguished himself at an early age by the publication of some poems. He studied medicine, adopted "the Church" as a profession, and in the midst of his ministrations applied himself to mechanics. A country parson of the old school, he entered completely into the everyday life of his parishioners. He was controlled with the desire to be of practical assistance to his "flock." In the spiritual sense he was well equipped for his work, but he soon discovered that the demands made on a country parson were not confined to matters pertaining to the next world; he must also be prepared to give advice on affairs in this. Accordingly he made a study of just those things which were likely to be of service to the poor. It is related of Dr. Cartwright that on one occasion he was visiting a lad who was ill with fever. Remembering a case in which putrefaction was, as he believed, arrested by the administration of brewer's yeast, and learn-

ing that this commodity was then in use in another part of the cottage, he got possession of some, diluted it with water, and in small quantities, gave it to the patient. When the clergyman left the cottage he began to show some uneasiness concerning his action; he entertained some doubts about the antiseptic qualities of the remedy he had so suddenly called to his aid. The boy, however, took a favourable turn and eventually recovered, and the medicinal qualities of yeast were not soon forgotten. Farming implements, too, attracted his attention, and although he did not claim to have studied the science of mechanics, he was able to suggest some improvements in the tools then in everyday use.

Dr. Cartwright had reached middle age when he turned his thoughts to the weaving industry. In a letter to a friend he described the incident which prompted him to make an attempt to construct his power-loom :—Happening to be at Matlock in the summer of 1784, he met some gentlemen of Manchester, when the conversation turned on Arkwright's spinning machinery. One of the company observed that as soon as Arkwright's patent expired, so many mills would be erected, and so much cotton spun, that hands could never be found to weave it. To this observation Cartwright replied that Arkwright must then set his wits

to work to invent a weaving machine. This brought on a conversation on the subject, in which the Manchester gentlemen unanimously agreed that the thing was impracticable; Cartwright, however, controverted the impracticability of the thing by remarking that he had lately seen an automaton playing chess. Was it more difficult to construct a machine that would weave, than one which would make all the variety of moves which were required in that complicated game? Some little time afterwards, a particular circumstance recalling this conversation, it struck the inventor that, as in plain weaving, according to the conception he then had of the business, there could only be three movements which were to follow each other in succession, there would be little difficulty in producing and repeating them.

Full of these ideas, he employed a carpenter and smith to carry them into effect. As soon as the machine was finished he got a weaver to put in the warp. The machine was set in motion, and to his great delight a piece of cloth was the result. As he had never before turned his thoughts to anything mechanical, either in theory or practice, nor had ever seen a loom at work or knew anything of its construction, it will be readily understood that his first loom was a rude piece of machinery. The warp was placed perpendicularly,

the reed fell with the weight of at least half a hundredweight, and the springs which threw the shuttle were strong enough to have thrown a congreve rocket. In short, it required the strength of two powerful men to work the machine at a slow rate, and only for a short time. "Conceiving in my great simplicity," writes Cartwright, "that I had accomplished all that was required, I then, on the 4th April, 1785, secured what I thought a valuable property by a patent. This being done, I condescended to see how other people wove; and you will guess my astonishment when I compared their easy modes of operation with mine. Availing myself, however, of what I then saw, I made a loom in its general principles nearly as they now are made. But it was not till the year 1787 that I completed my invention, when I took out my last weaving patent, August 1st of that year."

Dr. Cartwright was too neglectful of his interests to make a financial success of his power-loom. He entered the field of invention because his genius forced him there, and when he reached the height of his ambition—to demonstrate the practicability of mechanical weaving—he displayed a too generous disposition; he disregarded entirely the financial prospects which his genius had opened up. The consequence was that he was exploited by unscrupulous manufacturers who, having learned of the

utilitarian character of his loom, adopted it and then attempted to deprive him of the credit that was due to him for the eminent service he had done the trade. The demolition of a large factory together with hundreds of his machines, and other untoward events, added to the growing mistrust with which he regarded the commercial world, led him to lament the condition to which his unrequited labour had reduced him. But he was not permitted to go unrewarded. Some merchants and manufacturers of Manchester petitioned Parliament to recognise the value of his work and a grant of £10,000 was made to him by the State.

Another man who greatly assisted the cotton industry by his inventive genius was Richard Roberts, a Welshman. When a boy Roberts made a spinning wheel for his mother. His great achievement was in connection with the self-acting mule. A period had been reached when Crompton's hand mule could not produce enough yarn to keep the steam looms running, and during a strike of all the operatives for more pay, some of the leading employers appealed to Roberts to help them. Roberts was too busy to listen to their early appeals, but, presently, he was constrained to help them. He directed a Crompton's hand-mule to be erected in his works, so that he might familiarise himself with its motions and study how to produce a mule

that should work automatically. The result was one of the greatest triumphs of mechanical genius. The new machine was at once adopted by the Lancashire spinners, for it dispensed with much of the manual labour hitherto employed for the various processes.

I have said enough to show that handlooms now belong to the historic province of antiquarian curiosity. It only remains to be said that the wonderful growth of the manufacture of cotton has been made possible by the extraordinary inventive genius of our race. Inventors of cotton machinery exercised their brains and brought their mechanical appliances to perfection in the face of serious opposition, and the fact that they worked in secret led the operatives to regard them as men who were deep in intrigue against them. Alarmists prophesied the end of labour; the workpeople were to be ousted from the mill to face starvation; populous districts now dependent for their very existence on spinning and weaving were threatened with depopulation. The operatives believed all this, and they "rose" against these "designers of mischief" and reduced the pioneers to destitution.

Yet, victimised by the capitalist and in fear of their lives from the melancholy short-sightedness of the operatives, these intelligent, untiring, clever,

ingenious men could not be subdued. Out of their labours have come the wonderful machines that form the equipment of the modern mill. By their ingenuity the growing demands of the trade could be fostered, and to the solid possession of accumulated manufacturing skill and knowledge we are indebted for the extraordinary development of the industry as we know it to-day.

CHAPTER V

COTTON GROWING UNDER THE BRITISH FLAG

To provide cotton clothing for the human race it is calculated that 42,000,000 bales of cotton, or 15½ lbs. for every human being, would be required each year. The world's consumption of cotton to-day is, approximately, 23,000,000 bales, and of this, during the last decade, the American crop has averaged about 13,000,000 bales.

The market for British goods extends throughout the world, and the industry, so far as it concerns this country, is unique in that it possesses about two-fifths (60,000,000) of the world's spindles, and has to depend entirely upon other countries (chiefly America) for its raw material. Herein lies a serious danger to the future well-being of Lancashire's premier industry. Our American kinsmen have always boasted that the Almighty had given to them the only soil and climate where good cotton could be grown in sufficient quantity to meet the world's needs; and that any attempt to grow cotton where God never intended it to grow, was doomed to failure.

COTTON MILLS OF THE WORLD.

Country.		Mills.	Spindles.	Looms.	Consumption, Bales.	Hands Employed.
Great Britain	1915	2,009	59,904,873	808,145	3,881,230	655,000
U.S. North*	1915	697	19,663,294	436,638	2,900,790	—
U.S. South	1915	754	12,737,498	253,202	3,164,896	—
Canada	1915	42	1,405,656	31,979	184,685	18,055
Germany	1914	372	10,162,872	230,200	1,979,958	375,000
Russia	1915	99	7,665,654	213,179	1,400,000	370,000
Poland	1914	38	1,322,257	31,000	325,000	50,000
Finland, etc.	1914	6	236,752	5,741	25,000	6,857
France	1914	430	7,400,000	108,000	1,120,000	160,570
Austria-Hungary	1914	160	4,941,320	170,000	842,591	175,000
Switzerland	1915	62	1,385,441	21,561	99,000	21,000
Italy	1915	480	4,600,000	140,000	850,000	170,000
Spain	1915	257	2,100,000	55,000	420,000	70,000
Portugal	1914	35	428,000	12,000	56,000	25,000
Belgium	1914	53	1,775,000	24,000	250,000	11,000
Holland	1914	65	606,646	39,800	105,000	25,000
Sweden	1914	49	461,764	12,442	100,000	11,810
Norway	1915	13	81,814	2,626	14,255	2,878
Denmark	1914	5	88,700	4,350	27,500	1,150
Bulgaria	1914	5	19,539	350	5,000	632
Turkey	1914	9	70,000	—	40,000	2,000
Cyprus	1915	1	1,574	—	500	54
Greece	1914	19	73,898	1,160	23,250	3,503
Egypt	1914	1	20,000	525	7,000	550
Asia Minor	1914	7	41,000	—	47,400	3,030
India	1914	271	6,778,895	104,179	2,143,126	260,276
China	1913	34	1,000,000	4,755	525,000	—
Japan	1915	175	2,657,000	25,443	1,553,919	111,712
Indo-China	1915	5	700,000	500	27,000	3,000
Philippines	1914	1	7,440	272	1,560	300
Brazil	1913	171	1,520,000	50,000	330,000	106,200
Argentina	1914	6	9,000	1,200	—	1,600
Uruguay	1911	3	—	300	—	—
Chile	1911	3	5,000	400	—	—
Peru	1910	7	52,250	1,750	12,600	—
Columbia	1914	9	20,000	941	3,520	2,591
Ecuador	1911	4	5,000	200	—	—
Venezuela	1915	4	19,000	500	6,216	1,800
Guatemala	1911	1	8,000	250	2,000	550
Mexico	1913	139	762,149	27,019	160,000	34,500
Total (estimated)		6,483	150,737,290	2,819,607	22,633,996	2,680,618

* Includes Western States.

From "Annual Cotton Handbook."

It has long been the avowed intention of the Americans, sooner or later, to consume in their mills all the cotton grown in the States. But they

regard with disfavour any attempt to extend the cultivation of the fibre in other countries. European and American cotton manufacturers, meeting in conference at Atlanta, in 1907, were told by the American cotton growers that they could rely with confidence upon the American cotton belt furnishing the world's ever-increasing demands, and that they might cease from troubling themselves about opening up other cotton fields. The Director of the Bureau of Agriculture told the Cotton Manufacturers at Washington that he thought the visit of the European delegates to the United States was the acceptation of the idea that America must continue to be the principal source whence the industry of every country in Europe would come to draw its supply, and that all other cotton plantations which existed, or were being founded, or existed only in imagination, were relatively of little importance. "I look forward," the Director added, "with confidence to a future when the United States, instead of exporting two-thirds of their crop, will work up the greater part of it at home, thus realising for their own country the enormous profits which accrue from the treatment of this textile."

What measure of success has been attained in furtherance of this ideal? During the five years ending 1895, the cotton crop of the States averaged 8,000,000 bales. In the following five

From International] LAGOS PLANTATION: HAULING COTTON TO GINNERY. [*Cotton Congress Report.*

years the average production was raised (in round numbers) to 9,000,000 bales, with a minimum of 7,000,000 and a maximum of 11,000,000 bales. This increase of 1,000,000 bales was accompanied by an increased consumption in America, which rose from 2,000,000 to 2,500,000 bales, or half the increased production. The result was a considerable shortage in the available supply of the raw material for the rest of the world. In the year 1900 the total crop was only 9,500,000 bales, and many mills in Lancashire in that year had to reduce their consumption by working short time, with a serious loss both to capital and to labour. Coming to more recent times we find that the American consumption in 1913-14 was 5,500,000 bales; in 1914-15 6,000,000 bales, and in 1915-16 7,250,000 bales. It is of supreme importance, therefore, that England should develop the growth of the cotton plant in her own colonies and dependencies, for it is economically and commercially unsound to depend almost wholly on one continent alone for the supply of the raw material to feed the world's spindles. The American Civil War revealed to spinners and manufacturers in this country how utterly helpless they are when unable to procure their main supply of raw cotton. The American crop in 1861 dropped from 3,826,000 bales (2,175,000 came to England), to 300,000 bales,

DISPOSITION OF AMERICAN COTTON CROPS.

Year ended Aug. 31.	Crop.	United States Mills.		Exports.
		South.	North.	
	Bales.	Bales.	Bales.	Bales.
1880	5,761,252	179,000	1,610,978	3,885,003
1881	6,605,750	208,000	1,730,937	4,589,346
1882	5,456,048	236,000	1,728,535	3,582,622
1883	6,949,756	340,000	1,733,096	4,766,597
1884	5,713,200	337,000	1,539,683	3,916,581
1885	5,706,165	298,000	1,455,125	3,947,972
1886	6,575,691	345,000	1,817,544	4,336,203
1887	6,505,087	401,452	1,710,080	4,463,009
1888	7,046,833	456,090	1,804,993	4,685,031
1889	6,938,290	479,781	1,785,979	4,830,463
1890	7,311,322	546,894	1,799,258	5,000,879
1891	8,652,597	604,661	2,027,362	5,856,194
1892	9,035,379	686,080	2,190,766	5,917,249
1893	6,700,365	743,848	1,687,286	4,500,047
1894	7,549,817	718,515	1,601,173	5,336,553
1895	9,901,251	862,838	2,083,839	6,889,577
1896	7,157,346	904,701	1,600,271	4,751,602
1897	8,757,964	1,042,671	1,804,680	6,092,537
1898	11,199,994	1,231,841	2,211,740	7,690,477
1899	11,274,840	1,399,399	2,190,095	7,454,161
1900	9,436,416	1,597,112	2,068,300	6,055,874
1901	10,383,422	1,620,931	1,967,570	6,649,152
1902	10,680,680	1,937,971	2,050,774	6,740,538
1903	10,727,559	2,000,729	1,967,635	6,771,398
1904	10,011,374	1,919,252	2,026,967	6,114,498
1905	13,565,885	2,163,505	2,282,145	8,773,037
1906	11,345,988	2,374,225	2,349,478	6,763,551
1907	13,510,982	2,439,108	2,526,390	8,503,270
1908	11,571,966	2,193,277	1,896,661	7,573,349
1909	13,825,457	2,559,873	2,680,118	8,574,024
1910	10,609,668	2,341,303	1,993,904	6,339,428
1911	12,120,095	2,363,616	1,993,576	7,770,842
1912	16,138,426	2,744,067	2,631,432	10,506,465
1913	14,140,000	2,772,000	2,619,000	8,780,000
1914	14,552,000	3,037,000	2,466,000	8,866,000
1915	15,136,000	3,271,000	2,817,000	8,369,000
1916	12,862,000	3,933,000	2,877,000	6,051,000

and for four years hardly any American cotton was exported.

It is predicted that in a few years time the world's spinning trade will require annually above 35,000,000 bales of cotton and the growers in the States hope to maintain the monopoly. What are we doing to meet the threatened danger to which I have referred ?

There is no cotton-growing country in the world outside India — not even the cotton-growing States of America—which has such a happy combination of suitable conditions for the cultivation of cotton—fertile soil, excellent climate, a large agricultural population, and a great network of railways—but the population require the guiding hand of the Government in the development of this highly important native industry. India at one time had a large market in Great Britain for cotton fabrics of very fine texture. Tavernier, in his diary (in the year 1600), notes that " if a person puts such garments on his body it is visible just as if he were naked. The merchants are not allowed to buy this cloth. All of it must be delivered into the hands of the King who has garments made of it for the inmates of his harem and the wives of noblemen, as the King and the noblemen find great pleasure in seeing their women attired in this wonderful texture." But times have

changed. Indian cotton, for the most part, is too coarse for English spinners, and India is now the largest market for British goods made largely from American cotton. Above thirty millions' worth of cotton yarn and cloth are sent to India from this country every year.

It is to India that spinners and manufacturers are now looking for relief in the production of raw cotton, for the opinion is firmly held that any increase in the American crop will only follow the stimulating influence of high prices. It is true that England consumes a comparatively small quantity of Indian cotton, but the tendency is for that quantity materially to increase. Indian cotton has been largely used in Germany. The spinners of that country, before the European war, used yearly about 400,000 bales of the cotton grown in India—practically one quarter of Germany's yearly consumption of cotton. Other demands on the Indian product come from Austria, Italy, Belgium and Japan. The Japanese use approximately 1,000,000 bales annually. English spinners, speaking generally, produce the finer yarns, whilst Continental, Indian and the Japanese spin the coarser "counts," and therefore use vastly more cotton per spindle. Whilst Lancashire owns two-fifths of the spindles of the world, she only consumes, on account of the fineness of her produc-

tions, about one-fifth of the annual cotton crop of the world, thus showing how important it is to deal with the question of the further development of cotton growing from the international point of view. The world's cotton crop, to-day, is three times greater than it was forty years ago, and if the raw material is to keep pace with the demand for cotton goods the extension of the cotton fields must be taken in hand immediately.

On four occasions since 1910, a deputation of the International Federation of Master Cotton Spinners' and Manufacturers' Associations has been received by the Secretary of State for India at Whitehall, when the vital importance of improving the quality and extending the cultivation of cotton in India has been urged and assistance from the Government sought. This International Federation, of which Sir Charles Macara, Bart., was the first President, was inaugurated in 1904, to further the welfare of the world's cotton industry, and includes within the scope of its operations everything in which interests common to all are involved. Lord Morley, when Secretary of State for India, said that the Government could not approve a policy which would mean the extension of cotton cultivation at the expense of food crops, but there does not seem to be the remotest possibility of cotton encroaching on the area under food crops, because, for example,

in the United Provinces alone (containing 61,000,000 acres) the food crops extend over 36,000,000 acres, while only one and two-fifth million acres are on the average under cotton, and there are still 10,000,000 of cultivable waste. If certain types of cotton were more extensively grown in India there would not only be a great increase in the consumption of Indian cotton in England, on the European Continent, in India, and in Japan, but Indian millowners would not be confronted with the necessity of importing American cotton.

Since the re-conquest by England of the Sudan in 1898, cotton culture has been carried on there with the assistance of the Government. The Agricultural Department has been organised specially with a view to ensuring that men shall be at work who are experienced in the cultivation of cotton, and who are able to contend with the dangers which attend the growing crop. Knowing that cotton can be grown in the Sudan, the Government have made experiments as to what was the largest extent and the greatest scale on which the growth of cotton could be encouraged.

This chapter must not end without some reference to the development of cotton-growing in the tropical possessions of the British Empire.

The British Cotton Growing Association was brought into existence in 1902, to develop and to extend the production of cotton in new fields in the British Empire. The predominating idea of the late Sir Alfred Jones (who was the mainspring of the Association's activities in its early days) and those associated with him, was that the industry should endeavour to free itself from its dependence on the American crop. The proposal was in the interest alike of the spinners and manufacturers and their workpeople, and the representative organisations of each gave their support to the project. After years of pioneer and experimental work, moderately large quantities of British-grown cotton entered the market, and as the experts say "quickly went into consumption." The increase in the acreage under cultivation and in the production of a good staple and the demand it has created during recent years, are such as to justify the claim advanced by the Association "that it is now definitely established that cotton of sufficient quantity and of every grade required for Lancashire needs can be produced within the Empire," and that by broadening the basis of supply, the evil of manipulation, so prevalent in the past, will be checked, and, in all probability, in the course of time stamped out.

Every year, in Europe, the forecast of the Ameri-

can crop is awaited with almost feverish anxiety. There are 150,000,000 spindles waiting to spin each year's cotton crop into yarn, and millions of looms depend on the spinner for yarn to weave into cloth. If the crop should not come up to the average because of unfavourable climatic conditions, or the operations of speculators prevent a considerable quantity of it entering the markets of the world, the textile industry is brought face to face with disaster. In such a contingency millions of operatives may have to be placed on short-time working until the new crop arrives, or the " cornered " cotton is released.

The work of the British Cotton Growing Association has extended over a large area. Experimental and pioneer work has been done in India, East, West and South Africa, the West Indies and Australasia. There was hardly a part of the British Empire, where the conditions offered any prospect of success, which did not receive attention from the Association's agents.

Africa is by some regarded as the cotton field of the future. Nigeria and Uganda are admirable places for cotton cultivation. There is a fertile soil, favourable climate, intelligent agriculturists and good transport facilities. The building by the British Government of a railway along the Niger has been primarily responsible for the great

APPROXIMATE ESTIMATE OF COTTON GROWN IN NEW FIELDS IN THE BRITISH EMPIRE.

(Bales of 400 lbs.)

	1908.	1909.	1910.	1911.	1912.	1913.	1914.
Gold Coast	200	200	100	100	120	100	100
Lagos	5,500	12,100	5,900	5,800	8,900	14,000	13,600
S. Nigeria	200	300	300	300	270	200	150
N. Nigeria	500	400	400	600	2,600	2,000	1,000
W. Africa	6,400	13,000	6,700	6,800	11,890	16,300	14,850
Uganda	4,000	5,100	12,000	20,000	29,000	26,000	42,000
Brit. E. Africa	300	300	400	500	900	1,000	500
Nyasaland and Rhodesia	2,100	2,800	3,400	5,300	7,200	7,500	8,000
E. Africa	6,400	8,200	15,800	25,800	37,100	34,500	50,500
Sudan	?	?	15,000	21,000	15,000	14,000	20,000
W. Indies	7,000	6,400	5,500	6,500	6,500	7,000	6,000
Sundries	500	500	500	700	1,000	1,000	1,000
Total	20,300	28,100	43,500	60,800	71,490	72,800	92,350
Approximate Value	£330,000	£450,000	£696,000	£840,000	£952,000	£1,074,100	£1,194,750

extension of the work in recent years. To-day good and cheap cotton is being grown in that country in largely increasing quantities. Fifty-four bales of cotton came from Uganda in 1904. Four years later 4,000 bales were shipped and, in 1911 there was a further increase to 20,000 bales. In 1914 it was estimated that the crop was double that of three years earlier, which, together with the seed, would represent not less than £500,000. This is the result of twelve years' working. It is confidently asserted that if the efforts of the Association are not in any way relaxed or hampered for want of financial support, the raw material to feed British spindles may in course of time be grown on British soil.

The British Cotton Growing Association does not actually grow the cotton. Its aim is rather to encourage in that work the natives and settlers in the different Colonies and Protectorates; to develop large plantations and model farms, and to act as agents for the distribution of good seed; to train the natives in modern methods of agriculture, to educate them in the use of up-to-date implements, and to establish ginning and baling factories so that cotton when grown can be efficiently cleaned, handled and marketed. Perhaps the greatest difficulty attending the work arises from the inadequacy of transport facilities, and it

From International] COTTON GROWING IN THE BRITISH EMPIRE. [*Cotton Congress Report.*

(Plantation showing Young Cotton Plants at Lagos.)

is in this direction especially that the Government can render valuable assistance.

It has been said that " cotton is the thread which unites the interests of the industrial democracy with the development of our great possessions across the sea," and the more these interests are developed and encouraged the greater will be the security of this vast British industry and the greater the prosperity of our colonies and dependencies.

CHAPTER VI

CLASSIFICATION OF THE WORLD'S CROP

It has not yet been possible completely to establish and classify the species of cotton (*Gossypium*). The varieties of cotton now grown and the confusion of the species through hybridisation make it difficult for botanists to come to any definite conclusion as to their origin. Still there are certain leading peculiarities which have enabled botanists to reduce the cultivated kinds to four primary groups. They are: (1) *Gossypium barbadense;* (2) *Gossypium herbaceum;* (3) *Gossypium peruvianum;* and (4) *Gossypium arboreum.*

The bulk of our cotton comes from the extensively cultivated fields of the United States. The species grown there is *Gossypium barbadense,* and it is divided into two clearly defined varieties. One of these varieties, Sea Island, is the best grade of cotton obtainable, whilst the American mainland crop, because of its size, grade and average length of staple practically regulates the price of cotton throughout the world. Sea Island cotton, said to have been introduced from the Bahamas in 1785, is in great demand for the better class of cotton

A LIST OF COTTONS.

THEIR LENGTH, COLOUR, AND THE COUNTS FOR WHICH THEY ARE SUITABLE.

Variety.	Average Length.	Relative Price.*	Colour.	Counts up to.	Remarks.
SEA ISLANDS ...	1¾	230	Cream	200	Very silky and regular
EGYPTIAN—					
Joannovitch ...	1½	140	Dark cream	150	Silky
Sakellarides ...	1⅝	145	Dark cream	150	Silky and soft
Nubari ...	1⅝	130	Light brown	100	Silky, but rather irregular
Abassi	1⅝	132	White	100	Now little grown
Brown	1⅝	125	Deep brown	100	Very regular
Upper	1⅓	115	Muddy brown	60	Weak and dirty
BRAZILIAN—					
Pernams, etc....	1⅛	105	Dull white	60	Harsh
Ceara, etc. ...	1	103	Dull white	60	Harsh
PERUVIAN—					
Rough	1¼	117	Cream	For mixing wool	Harsh and wiry
Mod. Rough ...	1¼	109	Cream	For mixing wool	Harsh
Smooth ...	1⅛	113	White	60	Soft, similar to American
Sea Islands ...	1⅝	132	Variable	100	Silky, but irregular
AMERICAN—					
Orleans ...	1⅛	105	White	60	Clean, soft, and strong
Texas	1	100	White	50	Clean and strong
Uplands ...	1	100	White	50	Softest of Americans
Mobile	⅞	95	White	50	Dirtier and weaker than other
INDIAN—					
Surtee, Broach, etc.	⅞	80	Light brown	20	Clean and strong
Scinde	⅝	55	Dull white	10	Poor and dirty
Bengal	⅝	55	Light brown	10	Dirty and harsh
Tinnivelly ...	⅞	82	White	20	Best of Indians
Madras, Western	¾	71	Light brown	20	Fair class
CHINA	¾	85	Dull white	20	Clean, rather harsh
SMYRNA	⅞	85	Dull white	20	Rather harsh
WEST AFRICAN...	1	90	White	50	Similar to American

* Approximate price on the basis of Middling American, 100.

From "The Cotton Year Book."

goods. Its qualities are a staple of from 1¾ to 2½ ins. in length, uniformity, strength, cleanness,

and flexibility, and it possesses a silken appearance not to be found in any other cotton. For this reason it is in great demand for the manufacture of mercerised fabrics. This variety of cotton is cultivated exclusively on the islands off the coast of Florida and on a portion of the mainland of Georgia, South Carolina, and Florida. The plant grows to a height of from 6 ft. to 12 ft.

American cotton is divided for commercial purposes into four distinct varieties, excluding the famous Sea Island variety, which for the purposes of commerce is not "American." These varieties are: Mobile, Orleans, Texas and Upland, and all are included under the term "Mainland," because grown in the mainland cotton belt which extends from south-east Virginia to Texas. The Orleans or "Gulf" cotton (so named because grown in the Gulf of Mexico) has a longer staple than any of the other kinds of "American Mainland." It is about $1\frac{1}{8}$ in. long and of a light creamy colour and fairly flexible. Texas cotton differs from Orleans in that it is a little deeper in colour and is shorter in staple. In the matter of strength it is above the American average. It is largely used for twist yarns. The cotton known by the name of "Upland," because grown on the uplands of Georgia and the district of South Carolina, is noted

EGYPTIAN GOVERNMENT ACREAGE RETURNS.

(In Feddans.)

Provinces.	1916.	1915.	1914.	1913.	1912.	1911.
Galioubieh	65,141	55,258	72,387	70,681	64,880	65,369
Charkieh	212,189	158,867	223,157	218,161	217,721	215,544
Dakahlieh	238,970	151,778	264,599	257,850	261,414	265,679
Garbieh	414,241	290,083	432,674	423,626	433,410	428,154
Menoufieh	118,454	103,298	127,220	124,520	125,949	126,900
Behera	240,874	177,730	253,206	244,717	242,862	245,877
Governorates	—	—	—	44	18	13
Total Lower	1,289,869	937,014	1,373,243	1,339,609	1,346,254	1,347,536
Ghizeh	32,739	23,941	41,883	41,692	44,958	43,463
Beni Souef	72,892	50,949	74,755	77,406	75,567	78,853
Fayoum	80,058	76,755	79,149	82,341	80,511	73,357
Minieh	122,743	68,301	115,836	120,390	120,734	118,847
Assiout	50,818	22,988	58,599	52,575	47,114	42,724
Ghirgheh	3,392	1,445	6,915	4,582	2,751	1,752
Ghene	2,293	1,885	3,954	4,144	3,587	3,938
Assouan	708	2,725	936	355	339	771
Total Upper	365,643	248,989	382,027	383,485	375,561	363,705
Grand Total	1,655,512	1,186,003	1,755,270	1,723,094	1,721,815	1,711,241

for its cleanness. This fibre is used principally for weft—the cross threads which are woven into the warp for which the stronger cottons are used. "Mobile" cotton (the name is derived from the port of shipment) is the poorest quality of American cotton. Whilst the length of staple of the Uplands cotton is about one inch, the Mobile variety is $\frac{7}{8}$ in.

Egypt supplies the staple for the superior class of cotton goods. Excepting the Sea Island, there is no cotton grown which has such a silky appearance, and which possesses all the other characteristics of a really good cotton. In the cotton markets of the world the Egyptian crop is divided into classes according to colour and length of staple. Mitafifi (known also as Afifi or Brown Egyptian) was the standard cotton of the Nile country. The length of staple is about $1\frac{1}{4}$ to $1\frac{1}{2}$ in. The name of this variety is derived from that of a village in the Province of Galioubieh.

The cotton known as Assili is a newer variety. It is a strong regular and clean cotton of a distinctly brownish colour, but it is now dying out. Abassi is Egypt's white cotton. It is grown in the Delta of the Nile. Ashmouni, cotton grown in Upper Egypt, and Joannovitch, in its day a superior cotton and named after the grower who began its cultivation, have now practically gone out of

cultivation. Sakellarides is a fine, glossy, long staple cotton resembling silk and approaches more than any other cotton to the famous Sea Island fibre. This variety is largely used in England for mercerised fabrics. Nubari and Voltos are other grades of Egyptian cotton fibre.

The alleged deterioration in the quality and colour of Egyptian cotton, about which there have been complaints during recent years, is said to date from a time following closely upon the erection of the dam at Assouan. In consequence of the general absence of rain in the Nile Valley the cotton and rice fields depend for irrigation upon the annual overflow of the Nile. The extent of the annual inundation was for many years the determining factor in the success or failure of the crop. The richer the alluvial sediment brought down from the washing of the Abyssinian Mountains, the more cultivable was the soil, and the finer was the quality of the cotton produced. About twelve years ago the dam erected at Assouan to regulate the irrigation of the valley and adequately to provide for years when the Nile was low, was completed. It is urged in some quarters that this great engineering work has done one great service at the expense of another. To-day the crop is larger because of a more efficient system of irrigation, but the river does not, as formerly, leave

a covering of rich alluvial sediment. This sediment is said to be lost in the modern system of irrigation. It falls to the bottom of the river before flooding takes place.

Some users of Egyptian cotton have declared that since the dam was erected, the cotton has steadily but perceptibly deteriorated ; that if the cotton of to-day had been delivered to a cotton-spinning mill twenty-five years ago, it could not at that time have been spun with the machinery then in use. "In order to build up the strength of the cotton the spinner of Egyptian cotton adopts the expedient of mixing with it the longer staple cottons, so that with the improved machinery and a poorer quality of Egyptian cotton, much the same result is reached as when Egypt provided the industry with some of the finest raw material. The characteristic brown colour of the best Egyptian cotton has, however, been lost." A few years ago the owner of a yacht complained to a manufacturer that his new sails were not of the same brown colour as those he had had on a previous occasion. The yachtsman invited a representative of the firm providing the sails to explain the reason, and the yachtsman was told that the sails were made of the best Egyptian cotton obtainable, and that it was impossible now to get the old rich brown colour. This, he thought, was due to the absence of the silt

which the high Nile, in former years, deposited on the cotton fields.

On the other hand, the dam has been successful in that it has raised the annual crop over 7,000,000 cantars, and even now the demand for Egyptian cotton largely exceeds the supply. Moreover, the harnessing of the waters of the Nile, while improving the yield of cotton, has lessened the risks of a shortage in other crops. But whilst the Egyptian grower may be invited to direct his attention to improving the quality of cotton sent to the Lancashire mills, it must be recorded that eminent authorities on the Egyptian product entirely disagree with those who assert that the dam has been in any way responsible for producing an inferior cotton.

The time of planting in Egypt is generally in March, and the picking season in Upper Egypt is in August and in Lower Egypt a month later. The picking is done mostly by children, who are closely watched and punished if they neglect their work. The cotton is carried away from the fields to the ginneries on the backs of camels.

Indian cotton on the Liverpool market is divided into three groups or classes—Surat, Bengal and Madras. The Surat group includes the varieties of cotton of which Surtee is the best and Scinde the poorest. The other cottons in this group are:

Broach, Dhollera, Bhownuggar, Dharwar, Oomrawuttee, Comptah, Khandeish and Bagalkote. The Bengal cotton is very like that grown in Scinde. It is coarse and dirty and short in staple. Of the Madras cotton, Tinnevelly is the superior product. Cambodia is used in England, but is now deteriorating. Spinners at one time regarded it as on an equality with American Uplands. Other cottons of the Madras group are known as Westerns, Northerns, and Coconda, but they are too coarse for the English market. During the American Civil War, which caused a cotton famine in Lancashire, the group of Indian cottons known as Surat had to take the place of American, and this coarser cotton sorely tried the operatives who had to spin it. "O Lord, send us more cotton, but preserve us from Surat," was the oft-repeated appeal at prayer meetings, and when the war ended, and the first consignment of bales of the American variety reached the Lancashire operatives, they were so overjoyed as to join with one accord in singing "Praise God from whom all blessings flow." A small quantity of cotton is grown in Burmah.

The cotton-growing fields in the Russian Empire are in Turkestan and the Caucasus, and the crop is largely used by Russian spinners. The length and quality of the Russian fibre have been improved since the farmers used the seed of the American

Upland variety. The indigenous cotton is of a coarse short staple.

The cotton grown in China is sometimes used in England when there is a shortage of American cotton. It is about ¾ in. in length, and is clean and white.

THE WORLD'S COTTON CROP RETURNS.

(In Thousands of Bales.)

Season.	America.	India.	Egypt.	Brazil, etc.	Total.
1915–16	12,953	3,819	—	—	—
1914–15	15,607	4,703	812	†6,973	28,095
1913–14	14,885	6,149	970	†7,796	29,800
1912–13	14,129	4,692	969	†7,716	27,506
1911–12	16,043	4,978	965	†6,374	27,560
1910–11	12,132	4,587	984	†6,324	24,027
1909–10	10,651	5,317	673	†2,768	19,409
1908–09	13,829	4,779	898	†2,885	22,391
1907–08	11,582	4,445	908	†2,916	19,851
1906–07	13,550	5,197	923	†2,803	22,473
1905–06	11,320	4,797	798	†2,542	19,457
1904–05	13,557	4,061	843	†2,172	20,633
1903–04	10,124	4,471	797	†2,760	18,152
1902–03	10,758	4,183	768	†2,804	17,913
1901–02	10,701	4,122	864	*1,052	16,739
1900–01	10,425	3,377	711	900	15,513
1899–1900	9,440	3,099	855	1,000	14,394
1898–99	11,235	3,477	730	1,000	16,442
1897–98	11,181	2,844	919	1,015	15,959
1896–97	8,714	2,999	778	1,010	13,501
1895–96	7,162	3,296	695	770	11,923
1894–95	9,893	2,656	610	460	13,619
1893–94	7,527	2,995	707	542	11,771
1892–93	6,717	2,751	684	438	10,590
1891–92	9,038	2,869	625	310	12,842
1890–91	8,655	3,022	545	300	12,522
1889–90	7,314	3,361	431	270	11,376

* Including China 200 and Asiatic Russia 400.

† Including all other countries.

Note.—The American bale weighs about 500 lbs., the Indian bale 400 lbs., and the Egyptian bale 700 lbs. Bales of other countries vary in weight.

From the "Annual Cotton Handbook."

Brazilian cotton is also used in England, and if it were picked better, handled more efficiently, and sent to the market in a cleaner state its use by English spinners would greatly increase. The cotton-growing land in Brazil is extensive and the meteorological conditions are favourable, but the methods employed in marketing the crop greatly depreciate its value.

In Asiatic Turkey a small crop of cotton is grown. Here, as in parts of Russia, instead of picking the cotton in the fields the bolls are cut from the shrubs, and the cotton removed from them in the homes of the growers. This method of harvesting the cotton is not recommended by spinners. They complain that the fibre, when treated in this way, is too leafy and dirty.

There are three varieties of Peruvian cotton—Peruvian Sea Island and Rough and Smooth Peruvian. The first of these has a silky appearance and the fibre is above the average in length. But it varies too much in colour and in length of staple to be mistaken for *the* Sea Island cotton. The plant of the rough Peruvian grows to a height of from 9 ft. to 10 ft. Its product is a coarse and wiry cotton and is generally used for mixing with wool. The third variety is a much softer cotton and is more extensively grown than the other two.

CHAPTER VII

MODERN SPINNING AND WEAVING

"THE most striking actions of machinery," Professor George Wilson has said, "are those which involve not only swift irresistible motion, but also transformation of the materials on which the moving force is exerted. Take, for example, a cotton mill. On the basement story revolves an immense steam engine, unresting and unhasting as a star in its stately orderly movements. It stretches its strong iron arms in every direction throughout the building; into whatever chamber you enter, as you climb stair after stair, you find its million hands in motion, and its fingers, which are skilful as they are nimble, busy at work. They pick cotton, and cleanse it, card it, rove it, twist it, spin it, dye it, and weave it. They will work any pattern you select, and in as many colours as you choose; and do all with celerity, dexterity, and unexhausted energy and skill. For my part I gaze with extreme wonder on the steam Agathodæmons of a cotton mill, the embodiments, all of them, of a very few simple statical and dynamical laws; and yet able, with the speed of race-horses, to transform a raw

material, originally as cheap as thistle-down, into endless and beautiful fabrics."

Now that we have brought the raw material to Lancashire—the greatest cotton manufacturing centre in the world—we will trace its manufacture (through its various stages) into yarn and from yarn into cloth.

We begin our inspection in the engine room—the source of the motor power which gives life to the wonderful cotton machinery and sends thousands of spindles rotating with their thousands of miles of thread. In the modern mill, and in some of the old-established mills, steam has been supplanted by electricity. It is claimed for electrically-driven over steam-driven machinery that a larger production can be secured from the same machines, and that owing to the smoother running the quality of the yarn is greatly improved.

In the mixing and cleaning room we see the bales of cotton as they are received from America or Egypt. The American cotton is badly baled. It is packed in coarse, dirty sacking and bound with hoops of iron. Spinners have a long-standing grievance with the Americans as to the way they ship their product. For years efforts have been made to get the growers to improve upon the old and wasteful manner of baling and handling cotton; they have been urged to imitate the excellent

BALES OF COTTON (AFTER SAMPLING).

packing of the Egyptian bale. In recent years some improvement has been made, but the careless method of baling is to-day responsible for a considerable waste. Although the seed has already been separated from the fibre through the agency of the ginning machine there is much extraneous matter to be removed, including seed and leaves of the plant, before the cotton is started upon the initial stage of manufacture. Such curious things as stones, logs of wood, and even cartridges have been found buried in the bale.

When released from its wrappings the cotton is in a very rough and matted state, and is thrown into what is known as a Bale-Breaker. The cotton is carried by travelling bands between rollers which are either fluted or spiked. By this means the fibre is separated before it passes on to the "Opener," another mechanical device for removing all impurities from the raw material. The "opener" has within it special appliances for continuing the process of breaking-up the matted cotton and removing foreign matter. Sometimes a "beater," working like the sails of a windmill at the rate of 1,000 revolutions a minute, is employed.

From the "opener" the cotton is delivered loose, to be drawn forward once more, pneumatically, within an iron tube, which carries it to the

level of the ceiling of the adjoining blowing and scutching room and drops it again on the floor beneath. Scutching is a further process of cleaning the cotton by blowing and beating. One of the main features of cotton spinning, which applies to all the processes, is securing regularity and evenness. In these early stages careful regard is had to principle, inasmuch as an error in quantity, if not rectified, would materially affect the ultimate result to the extent of changing what is called the " count " of yarn. To secure this regularity, when the cotton has been taken by women and placed as evenly as possible on the lattice creepers which convey it to the scutcher, there is at the point where it enters the machine, an arrangement of rollers, with compensating movements, so that only a certain amount is allowed to pass in at a time. Within the scutcher it is again beaten and subjected to strong currents of air whereby more dust and dirt are taken from it, and it is eventually discharged between cylinders as a smooth felted web like a sheet of wadding rolled up in the form of a bobbin, and known as a " lap." Sometimes the intermediate travelling of the cotton from the " opener " to the first scutcher is dispensed with by a machine which affects the two processes continuously.

Further to purify the cotton and to attain the

desired regularity and evenness, five of the " laps " are taken and placed upon the creeper of the finishing scutcher, and are finally drawn out into one large lap, ready for the carding machine. This finished lap is weighed to ascertain that it contains the required quantity for the count of yarn which has to be spun. In the Card-room the cotton undergoes its final cleansing process and receives treatment of the most delicate and important kind. Hitherto no attempt has been made to separate and arrange the fibres of the cotton. Though partly cleansed and delivered in a smooth-web-like form, the original confusion of fibres still prevails. In the carding engine the visitor sees a machine into the back of which the web from the scutcher is placed on a roller. He sees it gradually disappear as it is being drawn into the interior, and then, passing to the front, he is shown the result in the shape of a fine ribbon-like gossamer film, technically called a " sliver," which is seen issuing from the machine, and coiling itself up in a can prepared to receive it. The processes by which this is obtained are hidden and are of a complicated kind. They may be briefly described as consisting of a series of large and small rollers working on a cylinder and called rollers and clearers. They are covered with fine wire teeth arranged in opposite directions, working with varied speeds and presenting oppos-

ing forces to the cotton which passes between them, the effect of which is to clear away the last of the impurities, comb out the fibres and arrange them parallel in the film-like form shown in the sliver. The appearance of this carded gossamer-like cotton as it comes from the machine, and is seen converging to a point and resolving itself into the sliver, is very interesting and in striking contrast with the matted web of which it originally formed a part. In this carding process all short and useless fibres have been thrown off with the waste, and as the scutching machine has been made to render a certain weight of felted web, so from this web is procured a certain length of sliver in proportion to the fineness of the thread which is to be spun. This is accomplished by arranging the speed or "draught" as it is called, so that from a given inch of web a certain length of sliver will be produced. One of the chief objects of carding is to free the cotton from all dirt and other impurities, because any defect in this direction will be seen in the last process and affect the quality of the yarn.

Two forms of carding machine are in use—the "roller and clearer" and that which consists of "revolving flats." It is not necessary to enter into minute descriptions of the differences in these machines, except to say that in the case of one the

CARD ROOM.

card clothing is placed upon rollers, and in the other upon a series of jointed flats which present an unbroken surface to the cotton as they revolve round the cylinder.

The element of waste enters into all the processes of cotton spinning. It exists in the form of refuse from the blowing, and scutching, and " fly " from the carding machines; in sweepings from the floors, and in various other forms. Consequently, from 100 lbs. of raw cotton, 10 lbs. will be thrown off in this way. Some of the finest portions of it disappear in the atmosphere, and form what is called " invisible waste." A large quantity of that which is secured is sold to waste dealers, who dispose of it again for manufacturing purposes.

The whole process of cotton spinning resolves itself into a series of drawings, doublings, and twistings. We have seen the cotton after being placed in the scutcher come out in a flat lengthened web. Then, from the carding machine it has issued in the form of a ribbon-like sliver. Now it is taken to what is called a Drawing Frame, where a number of these slivers will be united in one. The Drawing Frame is an interesting machine. It consists of three parts or " heads," each acting independently of the other. To the first of these heads six cans are taken from the carding machine for the formation of each sliver. The slivers from

these are taken hold of by rollers running at varying and nicely-adjusted speeds which deal with them with a finger-and-thumb movement, uniting the whole of the slivers in one, at the same time drawing this out to the required length, and by an ingenious movement, coiling it once more into a can. Six of these slivers are then taken to the next head and the process is repeated. A third time a combination of six is made and the sliver drawn out which now contains within itself 216 of the original slivers as they issued from the carding machine. To such automatic perfection has this machine been brought that if one of these light filmy slivers should happen to break, the machine is instantly stopped. This appearance of conscious movement is a very curious and attractive feature of the drawing frame.

Up to this time the cotton has had no twist imparted to it. It has simply been drawn out with the fibres arranged as parallel as possible. It is now taken to the slubbing frame. Here the slivers are treated very much as in the drawing frame, save that after passing from the rollers they are wound upon bobbins, arranged in connection with spindles, at the front of the machine. These bobbins work in conjunction with a spindle and flyer, revolving at the rate of 600 revolutions a minute, and in this operation the sliver is consider-

ably reduced in bulk and gets its twist. The cotton is now taken to the intermediate frames where the contents of two bobbins are united and wound upon one, the cotton being made finer and more round and the result is a combination of 432 of the original slivers. The mechanism of these fly-frames is very similar, their object being gradually to bring the cotton into a condition for spinning. The difference in treatment consists in the arrangement of the speed of the rollers for the delivery of a fixed quantity and giving the needful twists to the strands. In the working of these fly-frames the visitor's attention is drawn to the manner in which the roving is wound upon the bobbin, it being necessary to adapt the motion to the increasing or diminishing bulk, the bobbin, when it is full, having tapering cone-like ends. This apparently simple result involves some of the nicest calculations in mechanics, and is far too complex to be understood by the casual, unscientific observer. It is sufficient, perhaps, to say that it is accomplished by an ingenious arrangement of wheels working with differential movements, in conjunction with a pair of cones which give compensating effects as the roving assumes the cone shape on the bobbin. As the strands get finer, the bobbins are proportionately smaller, and the number of them is increased, as shown in the "Jack" or roving

frame, which is the last of the preparatory processes. In this frame two bobbins are wound into one, giving a result in the united doublings of 864 of the original carding slivers. In all these operations of drawing, the workpeople engaged are mainly women and girls.

At this point the roving is tested, a given number of yards being taken and weighed to see that the result is in accordance with the count which has to be spun. What is meant by "counts" of yarns? Cotton yarn, if wound into hanks from the cop, contains 840 yards in each hank. The "count" means the number of these hanks to a pound weight of yarn. So that if "sixties" are being spun, there will be sixty hanks, of 840 yards each, in a pound; and so on with the "counts," the number increasing with the fineness of the yarn to be spun.

When it has left the jack frame, the roving is ready to be converted into yarn, and for this purpose is taken to the spinning room. The machines used for spinning are self-acting mules of the latest construction. There are two other ways of spinning yarn—by the throstle and by ring spinning, but it is not necessary here to describe them, except to say that they represent a continuous motion as distinguished from an intermittent one which characterises the mule, and that they dispense

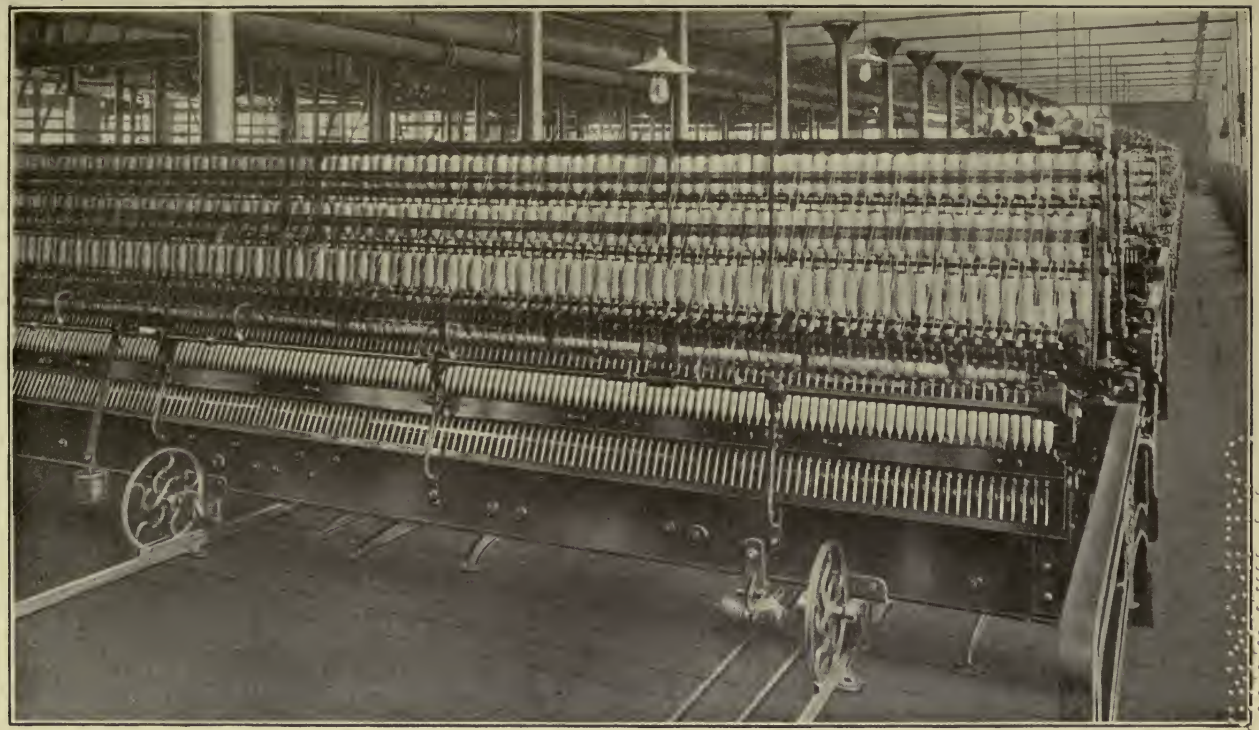
with the carriage which is necessary in the latter.

In the Spinning room the visitor will see a number of mules ranged opposite each other in pairs and extending the whole length of the room. Dividing these at certain distances are headstocks, each of which is a wonderful combination of wheels, levers, and other complications which work right and left, and control the movements of the mule. At the back of each mule the bobbins of rovings to be spun are arranged in creels. Beneath these on the beam or fixed portion of the mule are rollers which act upon the rovings with differential movements, as on the drawing frames uniting the contents of two bobbins into one and drawing it out to the required length. In front of this mixed portion is a wheeled carriage which works on a tramway and moves backward and forward in the intermediate space. On the front of the carriage the spindles are placed to the number, in some cases, of 1,500 to each mule.

The roving having been attached to the spindles, which revolve at the rate of about 10,000 revolutions a minute, as the carriage moves away from the rollers outwards, it draws with it the yarn, the revolution of the spindles also giving the twist to the strands. When the carriage stops, there is a pause in which the spindles stop and the rollers

cease to give out rovings. The spindles then perform a reverse movement of short duration to unwind the thread attached to them, called "backing off." Then the carriage moves back to the frame, and in this movement the yarn is wound round the spindles, an ingenious contrivance of wire, called a "faller," acting like a finger in arranging the thread. When the spindle is full, the yarn is cone-shaped at each end, and is called a "cop." When the cops are perfectly formed and complete the machine is stopped. It is then necessary to clear the spindles and start them again with fresh yarn. This is called "doffing," an expression which survives in the west country word "doff," which means to put off, a contraction of "do off."

The operatives employed in spinning are men and boys, called "minders" and "piecers." Each minder takes charge of a pair of mules which work opposite each other. He has under him a big piecer and a little piecer, whose duties are to piece the ends of any broken threads, keep the mules clear of waste and gather the cops from the spindles. The yarns spun from these mules are of two kinds, warp and weft. The warps have a harder twist given to them than the weft. Looking at the fine thread which is being spun from these mules, it is not easy for the visitor to realise the fact that in it is the combined result of 1728 of



SPINNING ROOM.

the filmy ribbons of cotton which he saw coming out of the carding machine. The length that is spun is also another source of wonder, when he is told that if 60's are the "counts" required, the pound of yarn representing that number would measure $28\frac{3}{4}$ miles.

When the cops pass from the hands of the spinner, they are taken to the weaving shed, and are of two kinds—warp and weft. The warp of a cloth consists of the threads which run the whole length of it, while the weft goes across, and is limited in its progress by the width. The cops which contain this weft, which is usually a little softer than the warp, are retained in their original form to be placed in the shuttles, while the cops of warp are placed in the hands of women who are called "winders." It is their duty to wind the contents of the cops upon bobbins, which is done in a Winding Frame, the threads being guided by gauges fixed in the frame, and brushed in their progress from the cop to the bobbin. The warps thus wound are taken to the beam warpers who are also women, who arrange the bobbins in a creel in numbers corresponding with the threads required. These threads are then wound on a larger roller, very much like a huge bobbin, and called a "warper's beam," care being required to have them laid side by side, a process which is assisted by the threads passing

through a wire frame. When five of these rollers are filled, they form what is called a set, and, after being weighed, are taken in hand by men who are called "slashers," who arrange the five in a frame, from which they are wound on to another roller, the accumulated threads laid side by side forming the width of the cloth. Attached to this frame is a trough containing size, through which the threads are passed as a certain amount of stiffening is necessary for warps. After being dealt with here between rollers and brushes, they are passed over a hollow cylinder heated by steam and are quickly dried.

It is a curious fact in connection with this warp dressing that when Dr. Cartwright had invented his power-loom, and established a weaving factory at Doncaster which failed, one cause of failure "arose out of the circumstance that cotton requires dressing while being woven, and that the wages paid to the men who had to dress the warp went very far to counterbalance all the economical advantages belonging to the power-loom itself. At length Mr. Radcliffe, of Stockport, invented the dressing frame, or machine by which the yarn is dressed before being placed in the loom." From the cylinder, the warps are wound forward continuously to another large bobbin-like roller, called a "weaver's beam," which eventually is taken to the loom.

An intermediate process, however, is necessary, and that is called "drawing-in." In the weaving of cloth, all the threads of the warps are passed through the eyes or loops of what are called "healds," which perform a very important part in the process. These healds are strong polished threads, suspended and arranged between shafts of wood. The number of these threads correspond with those of the warps. To understand the work of these healds, it should be explained that there are three important movements in weaving. First, the lifting of the threads of warp to allow the weft to pass through by means of the shuttle. This movement is called "shedding." The second is the shuttle movement, from side to side, by which the weft is conveyed. This is called "picking," and the weft threads are called "picks." The third motion is the beating up of these weft threads to each other, when they have been passed through the warp. The healds lift the threads, and perform the work called "shedding." For the accomplishment of this purpose we are shown a frame containing healds, and a warp beam above it. A girl seated below draws each thread of the warp down, and passes it in its turn through the eye or loop of the suspended heald. On the other side of the frame is another girl who is called a "reacher-in," who takes

the threads as they are passed to her, and places them in turn between the wires of a narrow frame called a "reed," which, when in the loom, will perform the motion of beating up the weft.

When the warps with the healds and reed are placed in the loom, the three movements of shedding, picking and beating up, begin. The healds are seen lifting up the required threads of warp, the picking stick is propelling the shuttle and carrying the weft, and the reed is moving backward and forward among the warp threads beating up the weft threads and so the cloth is gradually woven. To distinguish the various makes of cloth, a heading is frequently introduced, which consists of coloured threads of weft, put in at the commencement of the weaving. The operatives engaged to watch this work are men and women, and sometimes one person has charge of four looms. It is the business of these weavers to keep the shuttles supplied with cops, and to see that the cloth is evenly woven, every piece being afterwards examined to detect the existence of any faults. If a warp thread breaks in the process of weaving, the weaver takes one of a tuft of short threads called "thrums" attached to the loom and joins the broken ends. If a weft thread breaks, the loom is immediately stopped by a simple mechanical

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arrangement similar to that of the drawing frame in spinning.

Differences in the production of woven fabrics are brought about in one respect by changes in the number and working of the healds, ingenious appliances beneath the loom called "tappets," governing these movements and producing the various complications among the threads of warp and weft, and so producing endless varieties of cotton cloths.

CHAPTER VIII

"WHERE MERCHANTS MOST DO CONGREGATE"

MANCHESTER Royal Exchange—a building designed for and dedicated to the cotton-trade—may be said to be the centre from which the many individual spinning mills and weaving sheds derive their dynamic force. All the branches of cotton manufacture—spinning, weaving, bleaching, finishing, printing and dyeing, etc.—represent a capital estimated in round figures at £250,000,000, and it is computed that a population of at least 3,000,000 is directly dependent for their daily bread upon the transactions which are entered into upon "the boards" of this Exchange.

The first Exchange synchronises with the beginnings of the cotton industry, but it was in no way comparable to the institution as we know it to-day. The Exchange has grown and developed with the trade, and culminated in the dignified building —now being greatly extended—which stands in the centre of the city.

The merchants who, in the latter part of the 17th century and the beginning of the 18th century "well and truly laid" the foundation of the cotton

industry, did not cultivate expensive tastes. They had their club where "the expense of each person was fixed at 4½*d.*, viz.: 4*d.* for ale and a half-penny for tobacco"; and Dr. Aitken, writing over a century ago, gives us a description of what seems to have been the origin of the Cotton Exchange: "There now resides in the Market Place of Manchester, a man of the name of John Shawe, who keeps a common public-house in which a large company of the respectable Manchester tradesmen meet every day after dinner, and the rule is to call for sixpenny-worth of punch. Here the news of the town is quickly known. The 'high change' at Shawe's is about six, and at eight o'clock every person must quit the house, as no liquor is ever served out after that hour, and should anyone ever be presumptuous enough to stop, Mr. Shawe brings out a whip with a long lash, and proclaiming aloud, 'Past eight o'clock, gentlemen,' soon clears the house. For this excellent regulation Mr. Shawe has frequently received the thanks of the ladies of Manchester and is often toasted."

In the year 1729, Sir Oswald Mosley, the Lord of the Manor, appreciating the difficulties attending the absence of a recognised meeting-place for traders, erected a building in the Market Place not far from Shawe's. It was intended "for chapmen to meet in and transact their business." The heads

of three rebels who swore allegiance to the Pretender —Captain Thomas Deacon, Adjutant Syddall and Lieutenant Chadwick, who were executed in London,—were displayed from the top of this Exchange, as was the gruesome custom of those days. For above forty years this building was the centre of some kind of trading activity, and for a considerable time it was regarded as little more than a " nursery school for petty crimes ; a nest for disease." By common consent it was known as the " Lazaretto." The trading was not confined to cotton merchants as was the intention of the founder and builder. Butchers set up their stalls there, and the place gradually degenerated into a kind of fair ground with all the associations common to such a spot. This alienated the cotton merchants and they surrendered their right to meet there. They much preferred to negotiate in the narrow streets or on a piece of ground known as " Penniless Hill " where (in 1794), those who had developed a foreign trade formed a Society " to resist and prevent as much as possible, the depredations committed on mercantile property in foreign parts, detect swindlers, expose chicanes and persons void of principle and honour in their dealings." Means were also devised to promote the safety of trade generally, and a " black " list of names of foreign firms who had surrendered their

right to be considered honourable traders was compiled.

The trade was now rapidly developing, and merchants and manufacturers set to work to provide for themselves an Exchange which should meet their growing business requirements. At a meeting of merchants in 1804 it was resolved to erect a building in Exchange Street "for the purposes of a commercial coffee room and tavern." But the building was more dignified in character than the use to which it was to be put seemed to suggest. We read that the porters' dress consisted of a "cock'd hat, a staff with silver head, on which was engraved the Manchester Arms, and the words 'Manchester Exchange,' a dark blue cloak-coat with gold lace at the collar and gold twist at the button holes." Another interesting record of this Exchange relates to the illumination of the general room with candles. Sometimes the large dining-room was used for Town's meetings. In 1812 a meeting was arranged to take place there to consider a proposal to present an address to the Prince Regent. Serious opposition, however, was threatened. On the appearance of the notice convening the meeting the following statement was printed and circulated among the cotton operatives and artisans of Manchester and the neighbourhood :—

"NOW OR NEVER. Those inhabitants who do not wish for an Increase of Taxes and Poor Rates—an Advance in the Price of Provisions—a Scarcity of Work—and a Reduction of Wages—will not fail to go to the Meeting on Wednesday morning next, at the Exchange, and OPPOSE THE 154 PERSONS who have called you together; and you will then do right to express your detestation of the conduct of those men who have brought this Country to its present distressed state and are entailing misery on Thousands of our industrious mechanics.

"SPEAK YOUR MINDS NOW before it is too late; let not the Prince and the People be deceived as to your real sentiments. Speak and act boldly and firmly, but above all be PEACEABLE."—(*London Courier*, April 10, 1812.)

The meeting was abandoned. On the appointed night, however, an angry mob assembled and declining to believe that the meeting was not to take place, broke into the room and wrecked the furniture. The military stationed in Manchester and Salford at the time were summoned to restore order. This was speedily done, but already damage estimated to exceed £600 was reported. The Committee passed a vote of thanks to the four Commanding Officers of the garrison and to the officers and men under them for services rendered; and from that time until Manchester ceased to be a garrison town all military officers in garrison in Manchester and Salford had the privilege of free admission to the Exchange—a concession allowed

to no other persons except elected life members (those who have been continuous subscribers to Exchange for sixty years).

The Committee of the Exchange afterwards refused to allow their building to be used for public meetings and rules were framed embodying the Committee's decision. In 1842 this prohibition seems to have been ignored by Mr. John Bright, who at this time was an unknown member. In his report of the occurrence the then Master of the Exchange said :

" On Tuesday, about five minutes after one o'clock, and during the most crowded time of 'Change, my attention was drawn to the room from which proceeded very great noise and disorder. I instantly went into the room where I perceived a gentleman (whose name I was after informed was Mr. John Bright, of Rochdale) standing upon one of the seats and addressing the subscribers. I immediately approached Mr. Bright and intimated to him that his mode of proceeding was an infringement of the laws of the institution, and requested him to desist from speaking in the room. He took no notice, but proceeded with his address amidst cries of ' go on,' ' turn him out,' ' pull him down,' etc. Finding that I could not be answerable for the consequences if he were allowed to proceed, I took the liberty of removing him from the seat on which he was standing. I had no sooner done this than I was elbowed and pulled about by Mr. Bright's friends who advised him to proceed. Mr. Bright still attempted to go on with his address, and I then informed him that

if he was still determined to proceed, I must give him into the hands of the police. This latter threat had the desired effect, and a cry of ' adjourn ' was raised, Mr. Bright and his friends leaving the room (in the rush to get out breaking a window) and addressed the people in Ducie Place from a staircase window near the *Times* office."

Queen Victoria paid a visit to Manchester in October, 1851, and the Cotton Exchange was used as the place for the reception. In the " Life of the Prince Consort," by Sir Theodore Martin, an extract is given from the Queen's Journal describing Her Majesty's visit to Manchester, in which the following passage occurs :—" We drove through the principal streets, in which there are no very fine buildings—the principal large houses being warehouses—and stopped at the Exchange, where we got out and received the Address—again on a Throne—to which I read an answer. The streets were immensely full, and the cheering and enthusiasm most gratifying. The order and good behaviour of the people, who were not placed behind any barriers, were the most complete we have seen in our many progresses through capitals and cities." A month later, Sir George Grey (Home Secretary) informed the Mayor of Manchester that it was the Queen's pleasure that the Manchester Cotton Exchange should henceforth be known as the " Royal " Exchange of Manchester.

The exterior of the modern Exchange is familiar to the many; the interior is familiar only to the comparatively few, for the "boards" are forbidden ground to all non-members. The "stranger's" gallery is the only part of the building where other than members are admitted, and to gain access to this gallery one must be introduced by a member.

On the "boards" King Cotton reigns supreme. It is rank heresy to talk about anything else. Indeed the merchants have not the time, much less the inclination, to think of other than "counts," "points" and grades of cotton. Their presence on the boards means business and nothing but business, so that words are not wasted in any direction except only as an introduction to negotiation. Hence the customary formula of the merchant of an earlier generation which has not yet fallen into desuetude: "Mornin', Owt? Nowt, mornin'."

Politics may occasionally be privately discussed, but only when the Legislature threatens to turn its attention to some branch of cotton manufacture. In March, 1917, the Directors suspended the rigorous rules of the Exchange in regard to politics in order to give the merchants the opportunity to pass a resolution against the new Indian import duties on cotton goods. The resolution was read to the merchants at "High 'Change" by Sir Arthur A. Haworth, and on being put to the vote was by him

declared "carried by about 5,000 to 10." Mr. Joseph Chamberlain, during one of his visits to the city, was introduced to the gallery of the Exchange. His presence was soon made known to the multitude of merchants below and there were cries of "Speech." Mr. Chamberlain expressed the pleasure it gave him to visit "this great and important centre of Lancashire commercial life," and in an unguarded moment or, perhaps, in complete ignorance of the rule against political argument, he turned away from cotton and had begun an excursion into the political sphere. The great Protectionist orator started off with some arresting phrases which would have culminated in much cheering had he happened to be in the right atmosphere for political dialectics. But Mr. Chamberlain was greatly surprised when he discovered that those who had just previously clamoured for a speech, were now shouting, "No politics!" Mr. Chamberlain waited for a lull in the disturbance to offer thanks and then gracefully to retire. Presently the shouting ceased, leaving just a murmur of disapproval. Welcoming this opportunity to touch, as he thought, non-contentious ground, Mr. Chamberlain essayed to express thanks "on behalf of His Majesty's Government," and was again interrupted. The distinguished visitor now betrayed a feeling of uneasiness

Photo by] MANCHESTER ROYAL EXCHANGE. *[T. S. Kirkpatrick, Manchester.*

(Protest at High 'Change against New Indian Import Duties. 1917.)

until it was explained to him that any remarks with just a flavouring of politics were prohibited. Mr. Chamberlain offered a gracious apology for his transgression and shortly afterwards withdrew.

Other distinguished visitors to the Exchange include the late Lord Salisbury, Lord Rosebery, and Dr. Nansen, the Arctic explorer. Lord Rosebery did not fall into Mr. Chamberlain's mistake. His politics were never so obtrusive. Lord Rosebery satisfied himself by saying that the sight before him was the greatest he had ever seen. He could only compare it to one other and that was the blessing of the people by the Pope of Rome. Nansen observed that he had visited territories where very little cotton clothing was used. Merchants declare that one of the greatest sights ever seen on the "boards" was on the occasion of the coronation of King George when about 5,000 men sang the National Anthem and raised cheers for the new Sovereign.

If one would see the Exchange at the height of its business activity a visit must be paid at what is called "High 'Change," when the large room with an area of 7,000 square yards (including the new extension), the largest of its kind in the world—is crowded with merchants. This is a remarkable sight from the gallery. From 2 o'clock until 2.45 the room is filling up rapidly and at High 'Change—

2.45—practically every square yard is occupied. We will suppose that Mr. H. wants to see Mr. T. and there are 5,000 men on the floor. Mr. H. knows that Mr. T.'s " stand " is immediately under one of the huge pillars which form a colonnade on either side of the room and that the " stand " of another of his customers is two or three feet to the right or left of another pillar. Looking down on this crowd of humanity from the gallery, and amidst all the apparent confusion, one can see individual merchants pushing and pressing their way to one special part of the house or specially marked pillar. Their course is often a sinuous one for they have to steer round groups of men who are earnestly striving to negotiate a bargain at the market price of cotton as quoted for that day and hour. Many attempts have been made adequately to describe the peculiarly muffled sound that reaches the gallery from the " boards." To the writer the confused and intermingled sound of this babel and the incessant shuffling movement across the crowded floor, united to produce something like the roar of a London Tube train when approaching a railway station.

But you tell me that this is the great Exchange where cotton yarn and cloth are bought and sold? Where are the goods? To the visitor there are no material evidences of the business in hand.

The bales of cotton are at Liverpool — Lancashire's "spot" cotton market—(or warehoused at the Port of Manchester) and it is on the Liverpool market price that all the business is done. The primary work of the Exchange is the transference of commodities. It is here that the products of the spinning mills and weaving sheds are disposed of for the home trade and the shipping houses for export. Under the central dome of the Exchange there is the following proverb: "A good name is rather to be chosen than great riches, and loving favour rather than silver and gold." The standard of trading on the Exchange is very high.

New York and Liverpool are the great cotton distributing centres. The bulk of the cotton for the Lancashire and Yorkshire mills comes from Liverpool, where, as I have already indicated, all the dealings are in "spots" and "futures." On this market the visitor will perhaps appreciate more readily than on the Manchester Exchange, the shades of difference in price. Not only are fractional coins dealt with, but these are divided into "points," each of which represents the one-hundredth part of a penny. In America the cent is divided into a hundred points, two one-hundredths of these approximating to a point on our market. Cotton is sold according to sample,

and it is the business of the broker to act as intermediary between buyer and seller. No one is more expert than he in testing and selecting just the grade of cotton required by spinners for certain classes of work. In the testing of samples of cotton a northern light is admittedly the best, and you will rarely find a broker with an office which does not provide a room with a northern aspect. "Through the medium of his conversation," wrote the late Mr. John Mortimer, "the broker leads you to fields that to you are fresh and new, and in imagination you become an extensive traveller. His knowledge of the fibre he deals in is more than superficial. He handles the cotton as one who is familiar with it. Long use has induced a sensitiveness of sight and touch in testing it, which enables him to arrive quickly at an estimate of its quality. His eye has become microscopical, and fine distinctions which would escape the ordinary observer are clearly revealed to him, and the way he gauges the staple of the lint by tension between his index fingers and thumbs has something in it of the nature of a fine art. As you converse with him you become aware that his office is the medium of strange currents of business flowing in and out, and extending from 'the flags' close by, to transatlantic distances. Now it is the telephone that is at work,

then messengers pop in and out with verbal quotations relating to the state of the market; next comes a cablegram from New York which you are told left that city only a few minutes before. The air seems electrical, and as an illustration of the rapidity with which transactions are sometimes effected you are informed of one in which a message, involving a purchase, was sent from the office to New York, an answer received, and the business satisfactorily completed in fifteen minutes."

But cotton landed at Liverpool is some miles away from the spinning mills, and the cost of transit from that seaport to East Lancashire is not inconsiderable. One of the primary objects in constructing the Manchester Ship Canal, twenty-two years ago, was that those who had cotton to supply to the mills of Lancashire might be able to send their bales direct to Manchester—the centre of the spinning industry—where, if necessary, it could be warehoused and conveniently distributed by canal or railway to the mill gates at little cost compared with the transport charges from Liverpool. Another important proposal was the establishment of a "spot" cotton market. With this end in view the Manchester Cotton Association was formed in 1894. The Manchester Ship Canal has greatly benefited the Lancashire Cotton and other industries by considerably reducing the cost

of distribution, but the original shareholders in the undertaking have not reaped the harvest which they anticipated. The late Mr. J. K. Bythell, who was for many years chairman of the Ship Canal Co., in 1916 explained that the disastrous event that so seriously prejudiced the position of the original shareholders was that the calculations on which the estimated revenue was based were completely upset. The Parliamentary Committees were induced to pass the Bill because it was proved that on the basis of the then existing cost of getting goods to or from Manchester from or to vessels in the Liverpool docks, it would be possible to give importers and exporters a large saving as compared with using the Port of Liverpool, and yet give the Ship Canal sufficient revenue to pay a dividend. But what happened? The Liverpool dock dues on cotton were reduced from 3*s.* 6*d.* to 2*s.* per ton. The railway rates on cotton from Liverpool to Manchester from 9*s.* to 7*s.* 2*d.* and on Manchester goods to Liverpool from 10*s.* to 8*s.* The advent of the Ship Canal competition also reduced the railway rates of cotton yarn to the East coast ports and sea to Rotterdam from 32*s.* 6*d.* to 22*s.* 10*d.*, and on machinery to Hamburg from 27*s.* 6*d.* to 17*s.* 6*d.* The railway rate on cotton from Liverpool to Manchester in 1916 was 7*s.* 5*d.* inclusive. The Ship Canal toll and wharfage rate paid for passing over

the Ship Canal and the use of the Manchester docks was 6*s.* per ton, and this sum did not include payment for labour in loading and unloading, so that the railways had been forced to reduce their charges for the transport of cotton since the Canal entered into competition with them for traffic.

The facilities for handling cotton at the Port of Manchester are generally admitted to be excellent, and the traffic over this waterway is growing. Normally the imports of American cotton at the Manchester docks amount to about 450,000 bales annually. The imports of Egyptian cotton amount to 220,000 bales. Roughly, the Egyptian cotton handled is one-half of the total import of Egyptian cotton into England. But Manchester is still without its "spot" market. The reason is that Liverpool with her great shipping facilities and her big market for cotton is rather too near her great rival. Merchants, too, hesitate to interfere with their existing associations with Mersey-side although they recognise that the warehousing accommodation and the methods of handling and distributing the goods at Manchester are not inferior—indeed in some respects are superior—to what Liverpool offers. But there is a growing opinion in favour of Manchester having her own market now that the large overseas ships come to the city.

A "spot" market in Manchester would have its

effect on the business done on the Manchester Exchange, and much of the cotton now warehoused in Liverpool would come to Manchester, thus considerably increasing the traffic on the Ship Canal.

CHAPTER IX

GAMBLING IN COTTON

Raw cotton of the value of between two and three hundred million pounds sterling—at an average price of 5*d.* to 6*d.* per lb.—(it is not likely that cotton will be so cheap again) is consumed yearly by the world's spindles, and the manufactured goods which in any one year are distributed over the world's markets are valued at over £500,000,000. The most serious evil to attend this great industry is the manipulation of the markets by the speculator. There are fluctuations in the crop from year to year. But the fluctuations in the price of cotton are not wholly governed by good or bad crops, for there exists the illegitimate as well as the legitimate speculator, and the operations of the former have occasionally crippled the market to an alarming extent and brought distress to the millions of operatives whose prosperity depends upon a good supply of cotton at a reasonable price. The lowest point reached for "middling" American (the standard cotton) was 3*d.* per lb., or £6 5*s.* per bale of 500 lbs., in February, 1895. The highest point reached (excepting the period of the American war, when cotton was 2*s.* 7*d.*

per lb.) was when Sully, by cornering cotton in February, 1904, brought about an advance in price from 5*d.* per lb. to 9*d.* per lb., or £18 15*s.* per bale. In the summer of 1915 the price of raw cotton was about 7¼*d.* per lb., or £15 2*s.* 1*d.* per bale, and in 1916 the price advanced to the hitherto unheard-of figure (again excepting the period of the American Civil War) of 1*s.* per lb., or £25 per bale. In June, 1917, cotton cost 1*s.* 8*d.* per lb., or £40 per bale. Every variation in the price of only one penny per lb. represents £2 1*s.* 8*d.* per bale, and on the average cotton crop of the world a penny per lb. will represent about £50,000,000. It will be seen, therefore, that the interference of a speculator who may not have even one bale of cotton to sell may easily dislocate this huge industry by gambling, for it is not the people who grow cotton or the people who use it, but the speculators, who largely determine the price.

The excesses indulged in in the "futures" market are considered to be the cause of high prices and violent fluctuations which so frequently attend the cotton industry. What are "futures"? It is a method of dealing in the raw material which, to the uninitiated, is most bewildering. The dealer in "spot" cotton (a term which denotes cotton which actually exists either at Liverpool or Manchester) is the man who buys his cotton at the then market price and settles for it promptly.

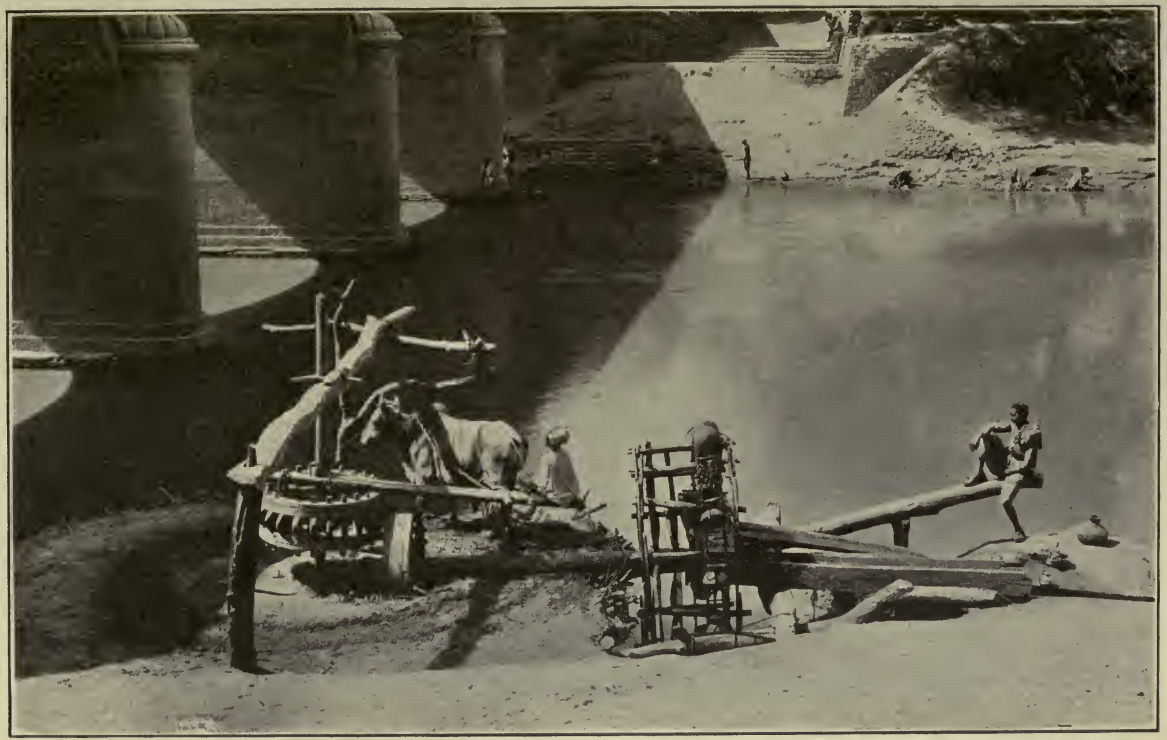

Photo by] PERSIAN WHEEL : IRRIGATING COTTON FIELDS. *[Bremner & Co., Lahore.*

But to operate in " futures " is a process by which a merchant either buys or sells cotton to be delivered at a distant date and is therefore opposed to " spot " transactions. The more intricate side of cotton buying is that dealing with " futures." To-day, operations in " futures " are conducted on a very extensive scale, but as far back as 1876 the practice of buying " futures " called into existence a cotton clearing house in order, effectively, to deal with debits and credits. The spinner who is asked to quote a price for yarn for delivery in (say) six months' time would, in the absence of a "futures" market, find himself faced with a very difficult problem. On the day of the enquiry the price of the raw material we will assume to be 6*d.* per lb. If the spinner were to give a quotation on the asumption that that will be the price six months later he would incur all the risks of fluctuating prices. But the spinner, through the operation of " futures," obtains from the cotton broker quotations for the delivery of cotton at specified times, and upon these quotations he bases his own for yarn, securing himself against loss by compensating transactions called "hedging." All "futures" are based on one class of cotton, viz., " middling " American, a fibre about $\frac{3}{4}$ in. long; but arrangements are made whereby the various grades of cotton are tenderable against " futures."

At the first International Cotton Congress, at Zurich, held in the year in which Sully had operated in cotton with such disastrous effect, it was decided to bring before the notice of the Cotton Exchanges of New York, New Orleans, Liverpool and Alexandria, the great injury done to the cotton industry by the enormous speculations and urge these Exchanges to consider what means could be adopted to prevent persons who had no interest in the trade, either as growers, merchants, spinners or manufacturers, from operating in the market to the detriment of the whole industry. It was further decided to bring the matter before the respective Governments of the countries represented at the Congress.

But the only practical way to end this gambling in cotton seems to be the extension of cotton culture in other fields. As the supply of cotton increases the danger arising from speculation decreases, and the difficulty attending financiers who attempted to "corner" it will be greater. Spinners and manufacturers do not desire that the price of cotton should either be too low or too high, but they do protest against the advancing of the market price to a prohibitive figure by the "dealer in differences."

The cotton crop of 1903-4, in which so much speculation took place, is computed to have cost

the spinners the enormous sum of £100,000,000 more than the planter got.

Cotton planters have been urged from time to time to hold for extreme prices, but it is doubtful if the adoption of such advice would in the long run be to their advantage. It must never be lost sight of by the grower that cotton supplies the clothing for the poorest people of the world in every country, and that applies more particularly to the 700,000,000 in India and China, to whom a great rise in price certainly means a limitation of their purchasing power, with consequently reduced employment for the spinners and manufacturers of the world upon whom growers of cotton are dependent. "So far as we in England are concerned," said a prominent Lancashire cotton spinner to the cotton growers, at Atlanta, in 1907, "we can tell you that it is the price that the poor Indian can afford to pay that determines what you will get for your cotton. If cotton gets below a certain price, then the Indian will purchase two or three shirts in a year, whereas when cotton is higher he will have to content himself with one. When he purchases two or three shirts there is such a boom in the cotton trade that everyone benefits. There is an old proverb in the best book of political economy that the world knows: 'There is that scattereth and yet increaseth, and there is that

withholdeth more than is meet, but it tendeth to poverty.' "

It has been the aim of all engaged in the manufacture of cotton goods for many years to reduce the cost of production by taking full advantage of science and invention, and great economies have been effected. The three sections of the cotton trade—producer, spinner and the manufacturer—have placed their brand of disapproval on the cotton gambler, and although there is a section of the trade who declare that it is not possible successfully to eradicate all speculation, there is a consensus of opinion that the destructive competition of the manipulator of cotton " futures "—who either buys or sells on the Exchange cotton which he does not intend to take or deliver, and creates an artificial price which for the time determines the price of the cotton crop, is unfair to the grower, who is deprived of the right to fix the price of his product, and disastrous to the spinner and manufacturer, and the labour employed, inasmuch as it seriously affects the whole industry.

At the Zurich conference a distinction was drawn by a member of the English Federation between the legitimate and the illegitimate speculator. The legitimate speculator in cotton he described as the grower who sold for future delivery with a view

that prices would decline, or held stock with a view that prices would advance: one who sold cotton that he expected to have or already had in his possession. Again, the legitimate speculator was the spinner who bought for future delivery or withheld from buying cotton which he required for his mill. It was held to be perfectly legitimate speculation on the part of the spinner who, whether he had orders for his yarn or not, bought cotton when the market seemed to be in his favour, or to buy from hand to mouth if he thought that prices were on the descending scale. The illegitimate speculator, on the other hand, was the grower, the merchant, or the spinner who simply dealt in "futures," selling that which he did not possess, or buying that which he did not want to use. The legitimate buyer acts on his best judgment to provide cotton for his mill. The illegitimate buyer acts for his own personal gain, and has proved himself, whether grower, merchant, spinner, manufacturer or financier, to be a pure gambler, and the greatest menace to the industry. Gigantic speculation in cotton robs the grower, the spinner and the manufacturer of the legitimate return on their capital and for their labour. It robs the labourer of his work and his wages; it prevents men using their best energies in the growing, the spinning, the manufacture and the sale of their productions.

But it is not an easy matter to free the industry of this speculating menace. Three years later, at the International Cotton Conference at Atlanta (1907), it was urged that spinners must sweep away the wild and unreasoning alteration and variation in prices forced by the Cotton Exchanges of Europe and America. Spinners recognise the honest, the honourable middleman and admit that he is a necessity between the grower and the manufacturer of cotton, but when a large percentage of the operations on these Exchanges are nothing but gambling deals it is considered that the time has arrived when these Exchanges should introduce a system of dealing which will have the effect of eliminating the highly speculative side.

CHAPTER X

COTTON FABRICS: AN ART MANUFACTURE

With wonderful skill and precision the decorative art of the calico printer has kept pace with the ingenuity of the spinner and manufacturer. From the hands of the designer and the printer all the forms of flowers of the field have proceeded, charged with the mingled colours of the rainbow, decorating calico or muslin, and by means of the Jacquard, manufacturers produce figures which approach the perfect embroidery of the needle. All the branches of the industry—the spinning, the manufacturing, the designing, the dyeing, the printing and the finishing—by their co-operation in the manufacture of the single vegetable product of cotton, are making fabrics of the most artistic kind, which so closely resemble the more expensive products as to puzzle any but the expert in this class of goods.

There is an infinite variety of cotton fabrics —coarse and fine, plain and fancy—and in Lancashire certain districts specialise in goods to meet the demands of the particular market they serve. The mills of Blackburn and the district

manufacture the loin cloths (dhootees) for the Hindoo, and other of the coarser goods for the Indian market. Coarse goods are also manufactured at Oldham and in the Rossendale Valley. Burnley supplies printing cloths, whilst goods of a finer quality and more elaborate in character come from Bolton and Preston. The Bolton mills are noted for their fine cambrics as well as for quiltings and for coloured material generally.

Cotton fabrics derive their names in many ways—from their texture, mode of weaving, their colour or mode of colouring, their surface finishing or place of manufacture. "Grey cloth" is a general term for all unbleached cotton cloth (it is called unbleached or brown calico in the South of England), which forms the largest part of Lancashire's export trade. "Shirtings" are extensively shipped to the Eastern markets, and shirt cloth is the material used for the manufacture of shirts and for other plain or fancy goods. "Sheeting" is the term used to describe ordinary bed sheeting as well as a grey calico sent to China and other markets; a plain, heavy grey calico is known in the trade as "Mexican." "T Cloth" is a plain grey calico very like the "Mexican," and is thought to derive its name from an old trade mark. "Domestic," as its name implies, refers more particularly to goods for home use, and "medium"

HANDLOOM WEAVING IN NORTH-WEST FRONTIER PROVINCE OF INDIA.

(Weaver seated in a hole dug in the ground. He works the shafts with his feet. Warps, being close to the ground, are conditioned by the moisture from the soil.)

is a plain grey calico used in the home and colonial markets. There are many kinds of "raising cloths." These have a weft which provides plenty of nap, but with sufficient fibre to maintain the strength of the web. Wigan cloth, manufactured in the town and district of Wigan, is a heavy fabric. "Croydon" is the name given to a plain calico with a glossy finish. Jaconet is a plain cloth but lighter than shirting, and "Sarong," a Malay word for a cloth used to wrap round the loins and used by both men and women, is now a comprehensive term in the Lancashire trade for printed cloths which are sent to India. Jean is a twilled cloth, and "Oxford" is a plain woven cloth specially manufactured for shirts, blouses, and dresses. "Harvard" approximates to the "Oxford" cloth, and "Regatta" is a stout coloured shirt cloth and is used largely in making sports' garments. Other cotton goods are classified as baize, brocade, bombazine, chintz, crêpe, cretonne, dimity, drill, flannelette, fustian, gauze, gingham, nankeen, print, rep, twill and velveteen.

Cotton is extensively blended with silk in many useful fabrics. Excellent sheeting is made from linen and cotton yarn, and the goods so produced are known as "union cloths."

Calico printing is the most important branch springing from the parent stem of the cotton trade.

It is the art and process by which colours are placed on the plain fabric, giving variations of form and gradations of colour more cheaply and expeditiously than in the loom. The art seems to have come from the inherent love of man (and woman) for decoration. The early Britons had no clothes except the skins of animals they killed in the chase. They could neither sew nor weave, but they liked to decorate their bodies. They used to paint their skins in patterns with woad, a plant that produced a blue dye.

Calico printing is of very ancient date in India, and derives its name from Calicut, a district where it has been practised from time immemorial. The Egyptians appear also, from Pliny's testimony, to have carried on, at a remote period, some of its refined processes. England received the art from France about the end of the 17th century, soon after the repeal of the Edict of Nantes, it having been previously derived by her from Central Germany. The trade first planted itself in London. A number of small establishments sprang up, and in 1700 it had so taken root as to obtain in its favour a prohibition of the cheap and beautiful printed goods of India. This Act was intended to protect woollen and silk manufactures from the competition of Indian goods: it had, however, the effect of stimulating and increasing the then infant calico print-

ing trade. The English had become accustomed to the use of printed calicos and chintzes, imported by the Dutch and English East India Companies, and they were spoken of as highly fashionable for ladies' and children's dresses, as well as for drapery and furniture, while the coarser calicos were used to line the garments.

In 1702, the print trade attracted the attention of the then Chancellor of the Exchequer and a duty of 3*d.* per square yard was imposed on calicos printed, stained, painted or dyed. Ten years later this duty was raised to 6*d.* By the same statutes, half these duties were laid on printed linens, the latter being a *home* and the calico a *foreign* manufacture. Notwithstanding the prohibitory law of 1700, Indian goods were largely introduced by the smuggler and freely consumed, in spite of a penalty of £200 imposed on the buyer or seller of Indian prints. A law, therefore, was passed in 1720, prohibiting the use or wear of any printed or dyed calicos whether printed at home or abroad, and of printed goods in which cotton formed a part, excepting only calicos, dyed all blue, muslins, neck cloths and fustians. The effect of this law was to put an end to the printing of calicos in England, and to confine the printers to the printing of linens. In 1736, so much of this Act was repealed as forbade the use or wear of

printed goods of a mixed kind containing cotton, and these fabrics were allowed to be printed, weighted with a duty of 6*d.* per square yard.

In 1764, calico printers established themselves in Lancashire, and after a period of 140 years from the first introduction of duty the print trade was allowed to enter into competition with other fabrics on an equal footing. The cloth at this time was a calico made of linen warp, crossed with a cotton weft, and was called Blackburn Grey.

Mr. Robert Peel, the father of the first baronet and grandfather of the great Sir Robert, who lived near Blackburn, was a cotton manufacturer and calico printer. Robert Peel made his first printing experiments secretly. There is a story that one day, in his kitchen, he was experimenting on some handkerchiefs when his young daughter came in from the garden carrying a parsley leaf. She suggested that it might make a pretty pattern. Her father looked at it, and complimenting her on her taste, immediately set to work to transfer its outlines to a piece of cotton cloth. It proved a success and the design became as popular in the cotton trade as the willow pattern in crockery ware. Robert Peel, "Parsley Peel" as he was afterwards called, was to calico printing what Arkwright was to spinning—a man of great business talent and prudence with a genius for

invention. The son of "Parsley Peel" the first Sir Robert, established printworks at Bury, and in a cottage not far from his works, his eldest son, Sir Robert Peel the distinguished statesman, was born.

Up to the year 1785, block printing, aided by the flat copperplate printing press, was the only method of calico printing. The block, with the impression cut upon its surface, was dipped on a stretched cloth or sieve, previously brushed over with colour and then printed on the cloth. It required 448 separate dippings and impressions to print one piece of calico 27 inches wide and 28 yards in length. This process, a very slow one, especially when more than one colour was used, was superseded by the cylinder printing machine, invented, it is said, by a Scotsman of the name of Bell. The engraving in this process was prepared on a cylindrical copper roller, by pressing the cloth in contact between this roller placed on an iron centre and a weighted iron cylinder placed above it, and as the copper cylinder revolved the cloth was drawn between the two and the impression made upon it. Whilst the block process produced six pieces a day, the machine with the same number of hands would produce any one or more colours from 200 to 500 pieces with fewer defects and greater accuracy.

The modern calico printing machine is made up

of a large central drum which is covered with a thick blanket. Engraved copper cylinders which print the pattern are placed against this large central cylinder round which the calico runs, the engraved cylinders taking their colour from revolving wooden rollers which are immersed in the dye. When roller printing was first introduced, over 100 years ago, only one colour was printed at a time. To-day, machines are made to print sixteen colours at one working.

Since the beginning of the great European war the industry has been greatly handicapped for want of special dyes. Hitherto the industry had largely depended upon Germany for these dyes. Since the Government interested itself in the manufacture of dyestuffs the position has been greatly relieved, and it is hoped to make the calico printing trade entirely independent of Germany in the future. To this end a staff of distinguished chemists is experimenting with a view to securing the brilliant and fast dyes which are so necessary to the industry.

Lord Moulton, who was chairman of the commitee appointed by the Government to investigate the position caused by the stoppage of the supply of German dyestuffs, told a meeting of north-country calico printers, at Manchester, that when he began to investigate the lack of dyes he found England consuming some two million pounds'

worth of dyes per annum. They were essential to an industry of something like £200,000,000 per annum, on which at least 1,500,000 workmen were dependent. Further, that of the two million pounds' worth of dyes that was required year by year barely one-tenth was produced within our own boundaries. The reason given by Lord Moulton for the decline of the coal-tar industry in England was "the English dislike of study. The Englishman is excellent in making the best of the means at his disposal, but he is almost hopeless in one thing. He will not prepare himself by intellectual work for the task that he has to do." By way of illustrating German concentration, Lord Moulton related the following story :—

"Once I found myself on the top of one of the Dolomite Mountains, and the only other person there besides the guides was a German. I found out that he was a chemist, and I began to talk upon a chemical subject. He told me he was only an organic chemist. He had not exhausted my resources, and I began to talk of coal-tar and pharmaceutical products. Then he told me that he was a coal-tar by-product chemist. That did not beat me, because I had just been fighting a case of canary yellow. I thought I would get some subject which was common to us, and I slipped into the subject of canary yellow. Still the same ominous silence for

a time, and then he said : ' I am only a coal-tar chemist dealing with blues.' But I had not finished. With an Englishman's pertinacity, not believing I was beaten, I racked my brains for a coal-tar blue—and I gradually, without a too obvious change of subject, slipped into that. Then he finally defeated me because he said in equally solemn tones, but equally proud of the fact : ' I only deal with methyl blues.' "

For the improvement of the coal-tar industry in this country, Lord Moulton suggested the formation of a large company—a company with a national control so far as to keep it in the right path ; a company which was co-operative between the producer and the consumer. Hence the formation of British Dyes, Limited, to supply the aniline dyes for calico printing.

CHAPTER XI

COTTON ORGANISATIONS AND STRIKES

A REVIEW of the cotton industry would not be complete if it omitted to say something about the powerful combinations of the masters on the one side and of the workpeople on the other. These organisations have existed through good report and ill, for many years, enabling the representatives of capital and labour to assemble together to discuss the propriety of advancing or reducing wages, and to consider and, if possible, adjust any differences that may be said to exist in any mill or mills.

To-day the masters welcome the opportunity to meet the representatives of the workers, for the spirit of conciliation is happily abroad. Strikes and lock-outs may sometimes affect their immediate purpose, but these arbitrary methods cause a great deal of unnecessary suffering, and bad feeling is engendered between the parties to the dispute which is not easily removed. In the early days, the masters regarded the development of the trade union movement with deep distrust. The leaders were "organisers of mischief"; emissaries to organise and wage civil war. They were certainly

not authors of peace and lovers of concord. Wars and rumours of wars prevailed, and there were displayed feelings of general misgiving as to the wisdom of legalising these "tyrannical combines." In this early period there was a constantly-recurring state of civil war between masters and men. The cotton trade was agitated with strikes—sometimes occurring in one firm, sometimes in several firms at the same time. Victory went at one time with the masters; at another time with the men, and in some instances the struggle became so violent that the masters had to apply to the police for protection.

The repeal, in 1825, of the Laws of Combination, gave to workpeople the right to combine to secure adequate remuneration for their labour, and to demand some amelioration of the conditions under which they worked. Before 1825 it was a punishable offence for workmen to combine to raise their wages, and it had repeatedly been made the subject of trial and punishment. But under a statute called Hume's Act, all the old statutes on the subject were repealed and simple combination, either on the part of the masters or workmen, was legalised subject only to certain restraints in the event of violence, molestation, or intimidation being proved against the members of the combination, or persons employed by them. There was a constant struggle

going on at this time between the capitalists and the operatives in the cotton trade. The former were striving—and with a measure of success—to make wages low and profits high; the latter to make wages high and profits low, and the argument of those who called for the repeal of the old laws against combination was that the great contest could not be conducted on terms of equality so long as the operatives were prohibited from combining. The masters were always able to meet together and effectively to combine against their workpeople's claims. In the debates on the subject it was urged that while the laws against combination failed in their object, the terror they inspired from being sometimes, though but rarely enforced, produced in the workmen a feeling of hostility against their masters, and a growing dissatisfaction with the laws of their country. It was thought advisable, therefore, to try whether a more lenient and liberal system might not be productive of good effects, and produce by the sense of mutual benefits and independence a good understanding between workmen and their employers.

The Lancashire Cotton Operative Spinners did not permit any delay in the formation of organisations, and in the year 1836, following a period of unprecedented prosperity, they engineered a disastrous strike (which lasted three months) for higher

wages, and the example thus set was followed by the operatives at Glasgow, with equally disastrous results. The Lancashire cotton workers "struck" the mills at Preston, in November, 1836, and returned to work, without gaining any concession, early in February of the following year, leaving a net pecuniary loss to the 8,500 operatives of £57,210 and a total loss to the town and trade of Preston of £107,196. Of the 8,500 operatives only 660 (all the spinners), voluntarily left their work, the greater part of the remaining 7,840 (piecers—children employed by the spinners—cardroom workers, reelers and power-loom weavers, and overlookers) being thrown out of employment through their dependence on the spinners.

When the mills had been closed for one month, the streets began to be crowded with beggars; the offices of the overseers were besieged with applicants for relief; the inmates of the workhouses began to increase rapidly, and scenes of the greatest misery and wretchedness were of constant occurrence. The spinners on strike received some financial assistance from their union; the cardroom hands and power-loom weavers were unassisted and helpless. Towards the end of the year the funds of the union were exhausted, and distress of the most acute kind was widespread. The masters were prevailed upon to open the mills

to give those operatives who wished to return to work an opportunity to do so. They, however, announced their determination to abide by their former offer of an increase of ten per cent. in the rate of wages, and required from all those who should enter the mills and resume work a written declaration to the effect that they would not at any future time, whilst in their service, become members of any union or combination of workmen.

The strike did not end until the first week in February, 1837. We are told that no systematic acts of violence or violations of the law took place during the trouble. Detachments of the military patrolled the streets to preserve order, but their services were not required. Some of the operatives died of starvation, thousands suffered severely from cold and hunger; in almost every family much wearing apparel and articles of furniture were pawned, the savings of years were entirely exhausted; heavy debts were contracted and shopkeepers were ruined.

The Glasgow strike continued for a period of seventeen weeks, and on an average weekly wage of thirty shillings, the direct loss to the operatives in wages was £91,290, and the total loss to Glasgow, £207,290. Three days before the operatives gave way the Strike Committee had been arrested in consequence of information connecting them with

a series of outrages, terminating in murder. The following statement published by the cotton manufacturers of Renfrewshire about this time will give some idea of the way in which life and property were assailed :—

" The master cotton spinners of Renfrewshire, considering that, on the night between the 2nd and 3rd of May last, the cotton mill of Messrs. Robert Freeland and Company, at Bridge of Weir, was wilfully set fire to ; that, on the night of the 9th September last, Robert Todd, cotton spinner at Arthurlie, was barbarously shot at when in his own house, and severely wounded ; that, on the night of the 26th November last, William Kerr, cotton-spinner at Bridge of Weir, was waylaid on his return home, and also severely wounded by the discharge of a pistol ; and that, on the morning of the 13th December last, an attempt was made to set fire to the cotton work of Mr. William Arrol at Houston ; and considering that anonymous letters have been sent to various operative spinners and to several masters threatening assassination if particular workmen remain in employment ; and that it has been discovered that other acts of felony are in contemplation similar to those which have already occurred ; and whereas it has been ascertained that these atrocious crimes have been committed and are intended by incendiaries and assassins, hired and paid by an Association of Operative Spinners in this county, whose purpose is to control the masters in the choice of their servants ; and it is known that almost the whole operative spinners of the district regularly contribute money towards the payment of rewards for the destruction of property and perpetration of murder—therefore, the master cotton spinners feel themselves bound to come forward in a

body, and in aid of the police of the county to adopt the strongest measures for the suppression of a system of crime so degrading to the character of the operatives, so injurious to their true interests, and so dangerous to the public peace. Accordingly, notice is hereby given, that this mill has stopped work, and the whole operative spinners who were employed at it are dismissed. And notice is further given, that as the mill will remain idle until the existing conspiracy among the operatives is completely subverted, it is in like manner determined that hereafter, so soon and so often as any symptom of the renewal of such a system of conspiracy and contribution shall be discovered, the whole mills of the county will instantly be again thrown idle, and work shall be suspended till the complete suppression of such renewed conspiracy and the detection of its principal instigators, the masters being resolved that no consideration will induce them to prosecute their business while their servants are concerned in designs so criminal and alarming."

In 1853, there was another disastrous strike in Preston. It lasted nearly six months. There were few among the strikers who remembered the great failure of the Preston spinners to dictate terms to the masters in 1836. The operatives at this time were getting about 26*s*. weekly and as workmen in other trades had received advances in wages, they decided to seek better remuneration for their labour. Attempts to come to an agreement between employer and employed failed. The masters were firm against an advance and the

operatives were equally determined on their side. There was nothing for it but an appeal to the strike.

The masters issued a manifesto which did not tend to conciliate; it rather deepened the estrangement between their workpeople and themselves. The masters stated that after agreeing to give an advance on the rate of wages, they regretted to find that the operatives had put themselves under the guidance of a designing and irresponsible body, who, having no connection with the town, nor settled position anywhere, but living upon the earnings of the industrious operative, interfered for their own purpose and interest in the relation between master and servant—creating, where it did not exist, and fostering and perpetuating where unhappily it did, a feeling of dissatisfaction and estrangement—and, in a spirit of assumption, arrogating to themselves the right to determine, and dictate to the operatives the means of enforcing the conditions upon which they should be permitted to labour. To this spirit of tyranny and dictation the masters decided that they could no longer submit, in justice either to the operatives or themselves; hence they were compelled reluctantly to accept the only alternative left—to close their mills until those operatives on strike were prepared to resume their work, and a better under-

standing was established between the employer and the employed.

In adopting this course the masters were fully sensible of the serious evils, moral and social, which must attend it, and which the sad experience of 1836 must have painfully recalled to the recollection of many. They felt, however, that the responsibility was not theirs; that it rested with those who had recklessly created the difficulty and forced this decision upon them.

The community generally were greatly relieved when the mill gates were again thrown open to the operatives. The tradesmen rejoiced to hear the familiar clatter of the clogged workpeople in the early morning as they hurried to the mill. The curling columns of smoke coming from the factory chimneys, which had stood lifeless for so long, meant a return to much-needed prosperity; the hum of the spinning machinery was music to the ear. The homes of the workers gradually assumed a brighter appearance and a note of thanksgiving was heard in the churches. The districts involved in the strike had passed through a severe affliction and here was the dawn of a brighter day.

But the operatives' organisation in other districts were soon involved in disputes with the masters' organisations. Discontented with the amount of wages they received or the number of hours they

worked, the operatives were ever ready to " strike " the mills if the masters refused to accede to their requests. The operative's rights, real or imagined ; his wrongs, questionable or unquestionable, formed the issue of many a conflict. The Bolton strike in the autumn of 1877, lasting nine weeks, involving a loss of £90,000 and ending in a reduction of 5 per cent. in wages, was the beginning of a more general strike in the following year—a strike distinguished from all others as the " great Lancashire strike." In this fight 300,000 people were immediately concerned, involving a large sum in wages. It was a time of general trade depression. The markets were greatly overstocked, and the operatives maintained that this was the result of increased machinery. The employers of North and North-East Lancashire proposed a reduction in wages of 10 per cent., and in Manchester a meeting of the Masters' Association, presided over by Colonel Raynsford Jackson, resolved that a 10 per cent. reduction should be universally enforced. The masters refused to submit the point in dispute to arbitration, and this deepened the hostility between masters and men. Realising that the strikers were partly maintained in the fight by the operatives at work, the masters added fuel to the flames by closing all the mills, and the operatives, although they feared that they would not

be able successfully to fight the organised combination of the masters, resolved to resist this proposed reduction of wages until starvation enforced submission. But resistance offered was not of a passive character. Infuriated mobs thronged the cotton weaving districts and great disorder broke out everywhere. Factory windows were smashed, vitriol was thrown at those regarded as oppressors, serious rioting became general, and the house of Colonel Jackson (whose life was in great danger) was pillaged and burned to the ground.

The Lord Chief Justice, in sentencing the men found guilty of this crime, pointed out that workmen had no right of power to compel the employer to pay for their labour the price that they chose to set upon it. The strike ended after nine weeks' struggle, the operatives having lost in wages during that period £700,000. Other disturbances occurred in the cotton districts in the period from 1878 to 1891, but they were of a sectional character. The year 1892 will be remembered for the twenty weeks' disastrous conflict which was ultimately settled by compromise and the adoption of a famous agreement (since abandoned by the operatives), which regulated negotiations between employers and operatives in the cotton spinning trade for above twenty years. This agreement was known as the Brooklands Agreement, because it was signed after

an all-night conference at the Brooklands Hotel, in Cheshire, where the parties to the agreement had secretly assembled in order to avoid any publication of the negotiations until a final settlement had been reached. This agreement, in its preamble, declared that "the representatives of the employers and the representatives of the employed hereby admit that disputes and differences between them are inimical to the interests of both parties, and that it is expedient and desirable that some means should be adopted for the future whereby such disputes and differences may be expeditiously and amicably settled and strikes and lock-outs avoided." This agreement did not admit of more or less than a 5 per cent. rise or fall at a time and this only after an interval of two years from the last alteration of wages. The comparative freedom from general stoppages in the cotton industry for twenty years was attributed to the operation of the Brooklands Agreement. Since the abrogation of this industrial treaty by the Operative Spinners' Amalgamation (because of the alleged unnecessary delay in settling "bad spinning" disputes) and the consequent withdrawal of the Cardroom Workers' Amalgamation, the industry has been greatly irritated by sectional strikes and threatened with "lock-outs."

Of the 55,000,000 cotton spindles in England,

44,000,000 are controlled by the Master Cotton Spinners' Federation, and 4,000,000 by the Cotton Spinners and Manufacturers' Association, the latter being an organisation in which the weaving section of the industry is most largely represented. This leaves about 7,000,000 spindles outside the Employers' Associations.

Practically all the operatives are members of their trade unions. There is not a body of workers in the country better organised, and their leaders are quite as well informed about the cotton trade and as familiar with all its technicalities as the employers. When there is a dispute representatives of both sides meet in conference with a view to settling it without an appeal to the arbitrament of the strike or lock-out. On these occasions little time is wasted in preliminary manœuvres. The whole position has been well reconnoitred beforehand. It is simply a hard fight for a position, and when (as is frequently the case) the parties to the dispute are equally determined not to give ground, the conference ends in a deadlock, and if the good sense of the combatants do not find a way out of the *impasse* by way of compromise, the operatives declare a strike and the masters counter-attack with an order to close their mills. But there is still time to avert a disastrous stoppage, and it is not unusual for an eleventh-hour peace to be announced.

The principal operatives' organisations are the Amalgamated Association of Operative Cotton Spinners, the Amalgamated Association of Card-room and Blowing-room Operatives, and the Northern Counties Amalgamated Association of Weavers. The United Textile Workers' Association, representing above 400,000 cotton operatives, is the body which deals with all legislative enactments affecting the cotton industry.

CHAPTER XII

A GENERAL UTILITY PLANT

THE fibrous contents of the pod was for centuries the only commercial product of the cotton plant, and when the silken filaments and the seed had been collected, the plant was treated as refuse and, as such, was either burned or used as a fertiliser. Scientific investigation, however, has brought other parts of the plant into commercial use, and in comparatively recent years other large and important industries in connection with it have sprung up and been greatly developed. The leaves and empty capsules and the seed of the plant are now prepared as fodder for cattle. The seed also furnishes an oil, resembling olive oil, which is used in the manufacture of margarine and for cookery, and soap is manufactured from cotton-seed oil mucilage. The bark of the cotton stalk is converted into bags and mats, and paper is manufactured from the fibrous waste. Our felt hats, floorcloths and upholstering materials are made from the gossamer fibres that cling to the seed after ginning. The roots have been found to contain medicinal properties, the ashes of burned husks are used by tobacco planters as

a substitute for potash, whilst from the waste cotton which is not convertible into yarn and cloth we get the wick for candles and oil lamps, brushes, coarse wrapping material and the powerful explosive —gun-cotton.

The most important manufactures, other than cotton, which depend upon the cotton plant for the raw material are :—Gun-cotton, paper-making, cotton-seed oil, and cotton-seed meal and cakes.

Gun-cotton is a substance of variable composition. It is obtained by soaking cotton in a mixture of nitric and sulphuric acids, and is remarkable for the low temperature at which it explodes. Dissolved in ether gun-cotton forms collodion, now extensively employed in photography. Collodion is also used by surgeons for cut and flesh wounds. The discovery of gun-cotton is attributed to Professor Schonbein, of Basle. It is related that when the discovery was first announced in England (1846) Professor Schonbein exhibited the properties of this new explosive to the Prince Consort at Osborne House, Isle of Wight, and a quantity of it was exploded in his hand without any untoward result. Encouraged by this innocent experiment a military officer offered his hand for a similar demonstration. This officer had previously declined the invitation of the Professor, but as the Prince Consort assured him that he had not suffered any

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inconvenience, the officer stretched forth his hand. The inventor placed a portion of the gun-cotton on his palm and ignited it. Then the officer suddenly jumped away with a shriek. What was to the Prince an innocent experiment proved a most disagreeable one to the officer. The Professor showed a feeling of alarm and commiserated with the victim. The injury, however, was not serious, and the company laughed heartily since the officer only submitted to the test after it was thought that the Prince had proved how simple and harmless it was. Since this time gun-cotton has been made into an explosive of great power and has largely superseded gunpowder. The use of the latter caused too much smoke for modern war and readily fouled the firearm. Gun-cotton, on the other hand, is practically smokeless and is largely used on that account.

After the spinner and manufacturer have wrought all the fibres of cotton which they can control into yarn and cloth, there remains a portion of waste inconvertible into those products. This waste has long been one of the valuable materials very extensively used by the paper-maker, to be ultimately applied to literary purposes. From this waste cotton excellent paper is made for the letter-press printer.

The crushing of the cotton seed for the oil it

contains has grown into an important commercial undertaking. One hundred years ago the first oil mill for cotton seed was built in Carolina, and so slowly did this new industry develop that during the next forty years there existed in the whole of the States only seven oil mills. In the next decade the number had increased to forty-five, and in the year 1900 the number of cotton-seed mills in America had increased to 357 and 2,500,000 tons of seed were dealt with. To-day there are about 840 mills engaged in the business of crushing cotton seed in the Southern States. The seed produced in any one year may be estimated (in round figures) at 7,000,000 tons. Of this amount about 5,000,000 tons are taken by the mills, and from this material is manufactured not less than 200,000,000 gallons of oil and 2,000,000 tons of cake and meal.

The oil from the cotton seed is largely used as a substitute for olive oil. For a long time the cotton-seed oil had to fight against the opposition of the olive oil industry and public prejudice. It was declared to be unfit for human consumption. The bitter taste which the oil had in its crude state, when first placed upon the market, did not help this new industry in its competition with the old established oil, but methods of refining it were soon discovered, and in recent years it has been made more

palatable and so like olive oil in taste and colour as to puzzle any but the keenest expert to detect the difference between olive oil and that extracted from the cotton seed. The virtues of this oil has long since been established, and the highest grade of it is now used in the manufacture of margarine, as a salad dressing, and for other culinary purposes.

The value of cotton-seed meal for the feeding of cattle was discovered soon after the oil mills were established, but was not extensively used at that time. During the last twenty years the value of the meal has been demonstrated and the trade in it has been greatly extended.

To sum up, this tropical shrub provides us with clothing, with food for ourselves and fodder for cattle, with the raw material for paper; it furnishes us with artistic tapestries for our furniture; all the peaceful arts draw largely upon it, whilst the scientist has converted the white fibrous substance into a destructive agent. The cotton plant is indeed a plant of general utility, and notwithstanding its deadly use on the battlefield, may be said to have exerted a wonderfully civilising influence in many parts of the world's hinterlands. We are told, indeed, that the natives of the New Hebrides have been converted from naked cannibals into cotton-clad Christians.

APPENDIX I

COTTON "FUTURES"

The following paper on Cotton "Futures" is regarded as the leading exposition on what is an extremely technical and highly important subject. It was written by Mr. Charles Stewart, proprietor and editor of the *Cotton Gazette*, and was read by him before the members of the British Association, at the annual meeting of that body at Liverpool in 1896. Mr. Stewart has kindly given me permission to reproduce it :—

What are "futures?" Their very name denotes that they have nothing to do with what is past or present—and let me state here at once that I am dealing particularly with American Cotton "Futures" (the greatest field for the exercise of this special kind of operation), although, broadly speaking, the system is applied to other growths of cotton and other kinds of produce. A cotton crop or a cotton stock in a marketable centre is a thing which exists. When such is offered for sale in bulk, either by sample of the actual thing or by recognised standard, that stock is called "spot" cotton.

It is on the spot—there to see, to handle, to be bought, a something tangible; and in the proper places, instituted by respective markets and associations, a faithful record of the quantities is kept for statistical and general purposes. In days gone by, such known stocks, whether in the United States or Great Britain, or the Continent, were the only cotton that could be bought or sold; and as, say, during the period of the American War, where a consumer could not put his hands on the actual supplies required for the engagements of his spindles and looms, he had terrible possibilities of loss and uncertainty staring him in the face. He could not re-spin his yarn, he could not re-weave his cloth. He could not substitute any other produce for that hungry machinery, although perhaps supplied with its proper food for one month ahead; he knew nothing, saw nothing, but what *was*, even if it were not immediately wanted for use.

Without going into unnecessary details as to how, in the gradual expansion of commerce, a new system grew side by side with increased production and telegraphic developments in particular, it is enough to say that one step followed another in a process of evolution—until nowadays in addition to what is offered for sale in the nearest and most convenient market, a man may buy or sell

(as the case may be) upon an acknowledged basis of quality, an equivalent to his actual requirements, or possibilities of production for delivery to him if a consumer, or from him if a producer, quite easily for twelve months ahead, before even the ground is prepared for the crop which the necessities of the world will require in due time. In other words, from a consumer's point of view (and I specially rather favour here a description of his position, as we in Great Britain are consumers and not producers of the raw material), if a spinner or manufacturer is offered a contract that will employ his machinery and hands profitably for, say, twelve months ahead, the, at first sight, awkward fact that he does not possess the actual cotton for the work, nor the hard cash to buy it, need occasion him no special alarm. With calm quiet merchanting he can protect himself at once. How does this come about? We are in the month of November. Looking at a Liverpool cotton market report in the columns of the daily or weekly press in normal times one would find a table of abbreviations and figures, thus :—

7.04	Nov.	6.87	Feb.-Mch.
6.89	Nov.-Dec.	6.88	Mch.-Apl.
6.87	Dec.-Jan.	6.88	Apl.-May
6.87	Jan.-Feb.	etc.	etc.

Alongside these abbreviated months, which ar

called "positions," are figures. The first signifies pence, and the following figures so many one-hundredths of a penny per lb. Thus 6.88 means 6.88/100*d*. What does this mean exactly? First of all let it be understood that the standard previously referred to is the "Middling" grade of American cotton, *the* standard of the trade. Any cotton expert knows what "Middling" American is, just as well as any ordinary man knows what a shilling-piece is. Cotton is classed into various grades, fixed authoritatively by experts, for which grades type standards exist. The ruling standard is always "Middling." There are higher grades, there are lower grades, but the standard is fixed. Therefore if a merchant sells a contract for future delivery, say, in November or December, for "Middling" cotton at a given price, both seller and buyer know perfectly well what they are dealing with. Nothing else is intended, and nothing else can be substituted, except under certain conditions, and anyhow the basis is unaltered. It is a safe contract for both. Such contracts, however, are subject to a clause which guarantees that the seller shall not tender any cotton below "Good Ordinary," which is lower than "Middling"—he may tender as much higher as he pleases. It may reasonably be objected, "Yes, but if he tenders below the standard grade at his option, how

is it fair to the buyer?" The answer is, that the buyer in this case has full recourse to an arbitration on the samples of the tender; and just so much as the tender is below *the* standard, so is he awarded by experts (subject to a right of appeal to a fixed committee) exactly such monetary compensation as the tender is below the strict contract. But observe, it *must* be within the limit of "Good Ordinary"; anything lower than this is rejected, or a penalty is exacted. On the other hand, if the season be one in which high grades are comparatively very plentiful, the seller may possibly tender higher than the standard; and, subject to arbitration and appeal as above, just so much as the tender is better than the standard, at the ruling prices of the day of test, does the seller receive from the buyer so much more money than the actual price of the contract.

The explanation of the character of the contract carried to finality may be amplified by the remark that a seller who contracts to deliver to the buyer a November and/or December contract is bound to fulfil his engagement on or before December 31 (he may do it at his convenience upon about every alternate business day between November 1 and December 31) or be liable to a penalty. This remark, however, does not altogether explain all, for this reason:—A man who buys "futures"

does not as a rule want the cotton itself; a man who sells "futures" does not want to provide the cotton. More generally in practice each man's turn is served (as I shall explain later) by his having concluded a contract, in the terms of which he gets perfect protection, for a standard quality at a given price with a responsible firm, and has, therefore, a guarantee which serves as a basis for some other operation of which this is only a part.

Having explained briefly what a contract is, let me show how it works as a contract in suspense, not yet fulfilled. For the working of "futures" contracts a most elaborate and complete machinery exists in what is known as the Clearing House of the Liverpool Cotton Association. Starting, say, with any day during the week, Monday to Saturday, A. may have bought from B., and therefore *vice versâ*, say, 1,000 bales of cotton in the manner cited. For simplicity's sake, let us assume that all these contracts have been concluded on the basis of 4*d.* per lb. Whatever contracts A. has bought from B. by the Saturday (from the previous Monday) stand good for next week's settlement, because once in each week the difference in price between buyer and seller must be adjusted in cash. At eleven o'clock on each Monday morning a Committee adjusts what are called the "settlement

prices" of the different positions on the board. This adjustment is open to no question. It is disinterested, and the prices fixed for the different months or positions at eleven o'clock on Monday morning are the exact values of all contracts at that hour. Supposing values have gone up during the week, since the contracts were made, say, ¼*d.* per lb., then the seller is indebted to the buyer for that difference of a farthing. But if values have gone down in the meantime, then the buyer is indebted to that extent to the seller, and the debit balance must be paid by either the one or the other into the Clearing House on the following Thursday morning at 1 p.m., or the defaulter is posted.

Although only the difference between the price of the contracts and the value on the day on which the settlement price is fixed, passes between A. and B. through the medium of the Clearing House, it must not be assumed that a ¼*d.* per lb. is of little consequence. Such a difference on the contrary, is a very important one (there are less differences; there are greater, for prices are constantly fluctuating). It means roundly at least £50 every 100 bales, and as many firms may easily be "long" or "short" 10,000 to 50,000 bales, 10*s.* per bale is a decidedly important item. To be "long" is to have bought; to be "short" is to have sold. So long as a contract is "open," that is, either not

matured or not "rung out" as the saying is (a process which comes about by the seller becoming a buyer, and the buyer becoming a seller of the same quantity and the position—a practice, with greater or less detail, constantly in operation) the differences have to change hands every week on the basis of the last Monday's striking prices, quite irrespective of the full value of the number of bales interested. This full value, say £8 to £10 per bale, never comes into consideration at all until and unless an actual tender takes place.

The proportion of cotton actually tendered and accepted is in the highest degree quite infinitesimal compared with the contracts entered into. It must not be assumed, however, that a contract can only be reversed and closed out on a Monday at 11 a.m. simply because the striking price is fixed then. A contract is liable to be closed at any time; and if this, for example, should be done on Tuesday, or Wednesday morning or afternoon, and so on, the difference due on that contract is that between the Monday's striking price and the value at the time of closing. In plain English let me state further—because I know that much misconception obtains on the point—that if a buyer or a seller, through his broker, buys or sells to-day 100 bales or more for Jan.-Feb. delivery, and his purpose served, he sells or buys again in November,

or at any intervening time, the same quantity of the same position, his responsibility in such contracts terminates at once. All that he has to do with is the difference between the price at which he bought and at which he sold, and his liability in a contract is at an end, whether it applies to a delivery one month away or twelve months away; and it is of no consequence whatever to him if the purchase is from Smith and the sale is to Jones. The responsibility rests with the broker, and it is adjusted between him and the Clearing House.

Now, having, as I think, made this tolerably clear, let me ask you to follow me in my attempt to explain how this "futures" machine works in its various ramifications towards the attainment of its great objective, viz., in its movement and moving and use of the American cotton crop. With this object I divide my subject into two main divisions—the first dealing with "Futures" as Sales, the second as Purchases. I will take the Sales first, as the first transaction that can happen with a marketable commodity necessitates that the possessor must be a willing seller. We will divide this consideration of "sales" into three sections:—(1) The use of "futures" to enable a planter to secure a favourable price while his crop is growing. In times gone by the tiller of the soil toiled away until harvest time, gathered his crop,

got it to market somehow or other, and sold his produce for what it would fetch ; generally speaking, when thousands of his neighbours were doing the same thing. The natural result was congestion, a universal demand for cash or exchange, and according to circumstances a greater or less diminution in value. For the farmer must have bread and clothing for his family, fodder for his cattle, oil for his lamps, fuel for his fires, and stores of all kinds for consumption. His cotton was of no use to him itself. It was his currency to buy the necessities of life, and must be exchanged. With it he bought, and buys, the dollars with which to pay his rent and other charges ; and if he could unload only at the time of harvest his property ran a great chance of depreciation, because everyone else was unloading about the same time.

Well, it may be asked, Where do " futures " come in ? They come in here. No man knows better than the farmer what his green and afterwards snow-white acres are likely to yield him. His crop may be according to locality—a quarter, a third, half, or even a bale to the acre (a standard bale weighs 500 lbs.). Let us assume that some great financial or commercial depression appears to be looming ahead in the autumn, or other violently disturbing feature like a presidential election, with the possibilities of a congestion at harvest time of a

ARRIVAL OF COTTON AT A GINNERY IN BURMAH.

great crop, and values down in the commercial marts of the world to all but the bare cost of production, if not below it. What a gloomy outlook for the realisation of hours and days and weary months of labour! Without the "futures" market the planter would be at the mercy of events, or the money-lender. In the July of 1896, "Middling" American in Liverpool was as low as $3\frac{3}{4}d.$ per lb.; the same standard for delivery in November was $3\frac{3}{8}d.$ per lb., while 75 per cent. of the cotton world confidently expected, and with some reason, that it would go down to 3*d.*—a price which would have meant dead loss on the plantation. What happened in August? From various causes prices shot up 1*d.* per lb. in a few weeks—and from comparative ruin every planter was raised into opulence if he could have sold then. Yes, but he could not exchange for cash what did not exist except in green stalk and undeveloped cotton bolls! But he could and no doubt did, in many cases, protect himself and although prices might go higher (and did go higher) at 3 to 5 cents per lb. above cost of production, he was well off if he could realise his probable out-turn, whether 100 or 500 bales. How could he do it? Easily enough. He had only to give a responsible broker in any recognised Cotton Exchange an order to sell so many hundred bales of "futures" for October,

November, December, or any other month's delivery, at the current good prices then ruling, and sit on a fence whittling sticks if he liked, while his crop matured, was picked, delivered and sent to market. His price was secured ; all he had to do was to deliver. Could he have done this without the aid of the "futures" market ? Certainly not.

We will now consider what I have classed as the second section under the heading of Sales of "futures." This section is second to none in importance, if, indeed, it is not the most important and legitimate function of the system, viz., the sale of cotton "futures" as a "hedge" by importers against shipments. Even by many people interested in the cotton trade this is only indifferently understood, and I have no hesitation in affirming with emphasis that were it not for the "futures" market, the crop nowadays simply could not be moved, except in the light of a sheer speculation. To bring this home it is necessary again to revert to the time when no "futures" market existed, bearing in mind, too, that crops then were only one-third to one-half the size of what they are to-day. In that out-of-date period then, the importing of American cotton was in comparatively few hands. The firms who did the merchanting were generally very wealthy, and their capital made them monopolists. Their agents in the States bought when they thought

the article cheap, negotiated their drafts on the home house or paid cash, shipped the produce, and trusted to luck or good judgment as to what kind of market the cargo would reach on arrival upon this side.

As it is only within recent years that the supply of the raw material has for any length of time materially overtaken the demand in Europe, the main purchases were only concluded in a time of congestion at the sources of supply, and the farmer's necessity was the merchant's opportunity. Remember there were no telegraphic advices in those days. Invoices and bills of lading came with the goods; ocean transit was much more tedious if not more dangerous, and many causes of more or less local interest sometimes occurred and combined—so that, while it is quite true that the cotton might arrive upon a market greatly advanced in price between the time of shipment and arrival, it was also equally liable to arrive on a market depressed, thus making the venture a serious loss, if realisation had to take place.

Fluctuations in those days were great. One half-penny or one penny or twopence per lb. variation in the course of a few days or weeks was not at all an uncommon thing; and when I remind you that ½*d.* per lb. profit or loss means, on 1,000 bales no less than £1,000, the risk is apparent.

Profits were greater than to-day, and this fact no doubt answered in compensation for losses on a year's trading ; but it was only the large capitalist who had a ghost of a chance to succeed and the trading was not regular as we know it to-day, it was opportunist. Yet wealthy as many of the great houses were, the immense failures and losses which the " flags " of Liverpool have seen in consequence of the utter absence of protection against loss, are to-day spoken of as expreiences completely out of question, in the light and practice of the facilities offered by " futures " for modern commerce.

To-day, an importer, through his agent buys in America a line of cotton. It may be 100 ; it may be 10,000 bales. The purchase is advised home by cable instantly, a drawee is found, the cotton is shipped, and by a sale of " futures " either in Liverpool, New York, or New Orleans, or any port where a " futures " market exists, to the exact weight—or as near as possible—of the purchase, the importer is absolutely protected against loss, whether the market declines 1/100*d.* or 1*d.* per lb. before its arrival. How does this operate ? In the first place, naturally the purchase is made upon a recognised basis of quality, which is not only effective here but in the United States also. To the cost of the cotton is added the freight and insurance necessarily incurred in transport, financing, landing

and warehousing charges here, a small commission for profit (for a rapid turnover is what is generally aimed at), and all these charges, say, bring out the actual value to *5d.* per lb. (any price will do for example's sake). A sale, therefore, of " futures " of a position, say, October and/or November at this price, during which months the actual cotton would be due to arrive, would be a perfect " hedge " —because if necessary the cotton on arrival could be tendered against the sale, and would be a complete fulfilment of a " futures " contract if carried to finality.

This purchase and shipment, if properly conducted, will, therefore, just work out at the market price of " futures " delivery for the month or months in which the cotton is due to arrive as described ; for (putting it in another way) from the price of the " future " have to be deducted all the costs of the transaction before the price can be fixed for the original purchase, minus charges. Now all this being effected, it is of no consequence whatever, broadly speaking, whether the cotton markets rise or fall between the time of the purchase and the arrival of the shipment. Why ? All " spot " business is based upon the value of " futures." As these latter advance or decline, so generally does the value of spot " middling." If general values have declined before the arrival

of the cotton, so that the actual bales of the raw material must be sold to the consumer at a lower rate than the original cost, therefore showing a face loss—then also the "future" contracts sold as a "hedge" against the purchase before shipment, have declined, and can be bought back again at the decline. For example, if the entire consignment were to be sold on arrival, the "futures" "hedge" would simultaneously be bought in the open market. One leg of the transaction would show a loss; the other leg would show a corresponding profit. So far as the "hedge" was concerned, the loss on the one leg of the transaction would be balanced by the profit on the other. Let it be remembered that the question of profit on the shipment has already been taken into consideration before the contracts were entered into, for if a reasonable profit were not assured or anticipated the trade would not have taken place. The principles laid down here are fixed; they regulate the business done, and it is only upon the basis of them that modern importing is conducted with any degree of safety.

Let us, however, go into everyday practice a little further than in assuming that a cargo is sold immediately upon arrival. It is not always so treated by any means—witness the fact that American cotton stocks fluctuate in Liverpool

between, say, 500,000 and 2,000,000 bales. A shipment arrives in dock, is warehoused and sampled, and on these samples it is offered for sale. The shipment is, say, 1,000 bales, possibly divided into ten lots of 100 bales, each slightly differing in character and value from the others. Nevertheless, the basis on which they were bought is unalterable and unaltered. It is most important to remember this. It frequently takes some time to dispose completely of a shipment; once warehoused, it is quite the exception for a big block of cotton to be sold at once. How are the "futures" dealt with? A thousand bales were bought and 1,000 "futures" sold as a "hedge." Just so. And if to-day from the warehouse, 100 out of the 1,000 are sold to a consumer, and 100 "futures" are bought in at the same time, the "hedge" expires for that 100 and so on until the lot is cleared out.

It is not difficult to see now that, granted a common basis for business, such trading can go on all the year round so long as there is 100 bales of cotton offering from the other side. Thus the trading is not opportunist, it is regular. It is immaterial to the shipper whether price be high or low. With his basis right (and the planter cannot sell if it is not), and his "hedge" assured, the business—that is, the moving of the crop, can go on with regularity utterly independent of

whether values are rising or falling—down at bottom prices, or away up out of sight; and the small capitalist can avail himself of this system as well as the great. Further, not only is the trading not opportunist, but it cannot be monopolised. Congestion and its necessary accompaniment, unduly low prices, are avoided.

I have not used the term before, but I think the "hedge" of cotton by a sale of "futures" against a shipment will have suggested already to the reader's mind that it is a perfect form of insurance —insurance against loss in value. And to whom? The merchant only? Not at all, but also to one without whom the merchant or importer simply could not get along. I mean the banker. I am not referring at all to marine or fire insurance; that is another matter, with which we have nothing to do here. Our insurance is against loss in value, and it affects the banker equally with the merchant. Why? Simply because with very few exceptions indeed a merchant is very rarely drawn upon direct by the original seller of the cotton. Some well-known financial house is drawn upon, accepts the bills, and holds the documents and warehouse receipts. The handling of the cotton in such a case is only done by the importer on trust for the banking house, although the profit or loss belongs to the importer. The "hedging" of the shipment by a

sale of "futures" is as important to the banker as it is to the merchant; it is his guarantee and insurance that whether the cotton upon arrival be worth the original drawing price or whether it be not, the sale of "futures" has protected the transaction to the extent of the decline, and that whatever deficit on one account may occur before realisation is complete, it is fully made up on the other.

Try to imagine what a security to a bank this "hedge" is if you can. One bank alone may very easily be financing 500,000 bales of cotton. A drop of ¼*d.* per lb. between the acceptance of the drafts and maturity for such a quantity would mean a deficit of £250,000. Such a possible risk if there were no protection by the "futures" sale would stop business almost altogether. In a word, any merchant nowadays importing cotton without "hedging" it by a sale of "futures" would be carrying on his business as a sheer speculation, and whatever his reputed means, no bank would trust him any farther than his available securities in its hands would warrant. Indeed, it would rather not have the account at all.

We will now consider a third manner in which "futures" are profitably employed as "hedge" sales, viz., in protection to spinners, manufacturers, and their agents, against unsold and possibly accumulating stocks of yarn and cloth.

Imagine a period of distressed or disturbed trade, when producers cannot sell their goods, and yet where they are not compelled to stop their machinery. Under these conditions a producer is "making to stock." Nothing is more likely than that he is doing so in falling markets, that every pound of yarn and piece of cloth added to stock is losing in value every day. Not only is he producing at a loss in an idle market, but that which he has produced is also further losing day by day in value.

A man may have to wait months before he can dispose of his yarn or cloth. In the meantime he may easily be ruined. He can sell cotton "futures" in the twinkling of an eye. There is always a market; always and immediate. Cotton "futures" are the consols of produce. They may not be a perfect "hedge" as a sale against manufactured goods; as a matter of fact they are not so, but they at least are the most perfect "hedge" obtainable in the world. Pound of raw cotton for pound of yarn or cloth they are the best sale he can make, and he "covers" himself accordingly until the tide turns and better markets are secured. As the value of his yarn and cloth declines, the value of his "futures" also gets less than the price at which he sold them; and at least to some extent what he loses on the one hand he reaps on the other

—for it can easily be understood that the value of raw cotton affects all plain cotton goods. Of course, here is a case, distinct and plain, in which a seller has no intention in the world of tendering the actual cotton against his sale; still less does he want to tender either cloth or yarn, although he may possess it. He could not do the latter, even if he wished, but he makes a convenience of selling a paper contract of so many pounds of the raw material on a given basis, at a given time, and when the convenience is served, he buys back a paper contract which cancels that representing the sale, any conditions of differences in and between being dealt with as they arose.

We have now done with the general utility of "futures" as "hedges" against stocks of the raw material, whether on the plantation, on shipboard, or in the warehouse, or as "hedges" against accumulated stocks of manufactured or manipulated cotton goods, and will, therefore, proceed to deal with "futures" in an exactly opposite sense to that already considered. We have dealt with them as sales; we will now treat with them as purchases—the whole idea of their utility in either capacity being one of insurance against loss in value in other operations, having one recognised standard of the raw material as a basis.

In the first place, then, as purchases we will

treat them " as ' hedges ' by shippers against sales of forward deliveries, when the actual cotton for this delivery has still to be brought from the producer or his factor." In much the same way as a planter wants to sell " futures " against his growing crops, and thus secure what he considers a fair price for his work long before he is ready to market his produce, so does a shipper, conscious or anticipatory of a good trade ahead, want to have something in hand, while his agents are busy (say in Europe) getting orders for that which is growing and coming on to market for use. The practice, therefore, comes about in the following manner: All cotton is not bought by a customer from a known stock, neither will a purchase of " futures " for delivery to him in any of the months on a basis " Middling " standard suit his exact requirements. Yet it is not only quite possible but also quite frequent for him to make a contract termed a " c.i.f." contract, with a merchant, to deliver to him at a specified time a special description of cotton, a special length of staple, a special strength, a special grade, a special style. The letters c.i.f. (or, strictly speaking, c.f.i.) mean, C. cost (the original cost of the article), F. the freight, and I. the insurance.

Upon calculations, unnecessary to detail here, a shipper of cotton will offer, generally during the

summer months, to deliver consignments ahead with the above specialities, to any consumer who wishes to buy them. Contracts pass between seller and buyer, and are equally binding upon the one to provide and the other to receive. The seller to some extent naturally takes a legitimate merchant's risk while the crop is growing. His emissaries are all over the cotton field, on the look-out to secure the raw material to fill the contracts made and report the progress of the growing plant. Crop prospects, let us say, deteriorate; the possibility of being able to secure the exact thing required becomes doubtful. Meantime prices show a tendency to rise, and the price at which the sale was made runs a chance of being passed. The planter turns stubborn, and holds for higher prices, a "bull" fever takes possession of the world, and by leaps and bounds cotton gets upon a higher plane of value.

This would be particularly embarrassing to the shipper if he had no loophole through which to extricate himself. He is already in a temporary dilemma in being placed in a position in which he cannot lay his hands upon what he actually wants and has sold, but this is a mere detail, and secondary to the importance of values getting away out of his reach. It is value, and the difference between loss and profit, which is all important to him. What

does he? He covers his financial responsibility by buying "futures" in an accredited market. The market, then, broadly speaking, may do what it likes. If he has a thousand bales sold c.i.f. ahead, and local or general circumstances combine to prevent him from providing himself with the actual thing wanted, but he has a thousand bales of "futures" bought as a "hedge" against possible advancing value; he is fairly safe. As much more as he may have to pay for the actual requirement in order to fulfil his contract, so much more is the difference on the "futures" contract worth to him to fill up the deficiency; and when he has secured by purchase and selection that which he has contracted to deliver he sells out his "futures" contract, which is no longer necessary to him. As, however, "futures" exercise one great function as sales—that of "hedges" against the imports already described—so do they exercise one special great function as purchases. This undeniably immense field covers those operations in which they are bought as "hedges" against sales ahead of yarn and cloth by producers of these, by their agents, and ofttimes by the merchants who ship goods abroad.

At the outset I alluded to the fact that if a producer of cotton goods is offered a contract that will keep his spindles and looms going and his work-

people employed for twelve months ahead—even if he did not possess the raw material required, nor the available cash with which to purchase it, even also if it were (as it is not always) in existence to be purchased—he need experience no special alarm; for with quiet, calm merchanting he can protect himself at once.

We will now go on with the "purchase of 'futures' as a 'hedge' against sales of yarn." On the boards of the Manchester Royal Exchange are to be found, practically every day in the week, the principals or representatives of every cotton spinning mill in the kingdom. Spinners from all parts congregate there to sell their yarn. We will imagine a busy time, meaning considerable demand. Large lines are being placed. Buyers are more needy than sellers, and they are not merely anxious to purchase a quantity of any special firm's production for immediate delivery, but possibly still more anxious to enter into engagements for the full or main part of the production of such and such a firm for many months even up to twelve months ahead. The spinner has capital, it is true, but if his consumption of the raw material were only 100 bales per week, and the contract offered were only for six months—under old conditions of only being able to lay his hands upon what was, in the shape of cotton, available, and pay cash for that, he would

have to expend no less than £26,000, and stow the cotton away somewhere until it was used up; either this, or take his luck or chance in picking it up in driblets as he could, or as his spare money allowed him to do.

Thus with the aid of the " futures " market any spinner of decent repute and very moderate capital can quietly consider such a long contract as suggested, accept it, and " cover " himself in five minutes, insuring himself against all loss. As I have said before, on the basis of " future " values is the value of all cotton, therefore of cotton goods. On that basis or about it, after much bargaining, the contract for yarn is concluded; therefore without waiting to proceed to the raw material market to select his actual and special requirements, the spinner has simply to telephone or telegraph down to Liverpool to his broker to buy so many hundreds or thousands of bales of "futures"—200 of this month, 200 of next month, and so on; and all risk to his profit, so far as providing his requirements for his engagements, is past and gone. He can go home and sleep, leaving it to more convenient seasons to effect his actual purchases and requirements of the raw produce. As he effects this latter from time to time in lots of 100 to, say, 500 bales, so does he part to the same extent with the " futures " already bought. If the market

has risen in the meantime, as much more as he may have to pay for his actual wants, practically so much profit has he upon his "futures" contracts—the one balances the other. We have already seen the reverse of the operation in other business. If the market has fallen in the meantime, true, he will have a loss upon his "futures," but then he has the less to pay for his actual cotton. The basis of the trade is not altered one whit. In other words, granted that his first calculations are correct, based on the value of "futures" at the time he enters into an agreement to supply yarn for forward delivery, and that he buys his "futures" there and then, so far as his buying or selling are concerned risk and loss are out of the question.

This is no less true when applied to purchases of "futures" as against sales of cloth by manufacturers. A maker of cloth, like a producer of the yarn which makes the cloth, frequently sells his production for many months ahead. True he cannot weave "futures" any more than a spinner can spin them; but oftentimes he cannot get the yarn he wants, any more than the spinner can select and secure the actual cotton which he requires. The manufacturer, therefore, cannot afford to run the risk of making a loss by waiting on the yarn market to accommodate him as to

price. He therefore buys cotton "futures" equivalent in poundage to the weight of yarn he needs; and he also is protected at once. There is plenty of yarn for him, he knows; but he may get a better chance of securing his possibly 1,000,000 weight of yarn than at the moment of his sale of cloth. As he picks up his yarn, so to the same weight does he dispose of his "futures." He has been insured against loss. Yarn agents and cloth agents follow the same process; so do the merchants who ship and contract to ship goods abroad.

The value of a house may have nothing in the world to do with the current prices of bricks and mortar, iron and timber. But cotton goods are not made out of these, nor out of wool or sugar, but out of cotton alone; and a rise or fall in the value of the raw material is a sure indication of a rise or fall in the value of the yarn or cloth made from it. Therefore on broad lines of value a purchase or sale of a "futures" cotton contract, which is always possible, is the next best purchase or sale to that of the manufactured article, which at the moment is not always possible.

These are the broad principles regulating the legitimate use of "futures," and Mr. Stewart claims that these broad principles are constantly in practice and unassailable.

APPENDIX II

SPINDLES AND LOOMS

THE following statistical table giving the number of spindles and looms in Lancashire and immediate district is based on information supplied in Worrall's "Cotton Spinners' and Manufacturers' Directory" for 1916. Messrs. Worrall state that the year ending December, 1916, witnessed a considerable increase in the total number of spindles employed in Lancashire, amounting to 1,162,159 (including doubling spindles). This is the largest increase since 1909. The looms for the same period show a decrease of 1,253.

—	Number of Firms.	Number of Spinning Spindles.	Number of Looms.
Accrington and district . .	63	726,980	39,764
Ashton-under-Lyne and district .	36	1,964,996	10,782
Bacup and district.	25	344,452	8,535
Blackburn ,, ,,	133	1,240,150	97,799
Bolton ,, ,,	112	7,397,642	24,030
Burnley ,, ,,	146	540,376	111,914
Carried forward	515	12,214,596	292,824

—	Number of Firms.	Number of Spinning Spindles.	Number of Looms.
Brought forward	515	12,214,596	292,824
Bury and district	45	1,060,524	22,454
Chorley ,, ,,	38	865,298	26,464
Clitheroe ,, ,,	18	150,136	9,863
Colne ,, ,,	85	147,500	27,070
Darwen ,, ,,	51	274,256	39,241
Denton ,, ,,	2	63,982	534
Dukinfield ,, ,,	15	843,912	971
Farnworth ,, ,,	46	1,502,384	12,838
Garstang ,, ,,	2	—	318
Glossop ,, ,,	17	914,592	14,270
Golborne ,, ,,	4	112,296	2,110
Great Harwood and district	14	64,376	17,188
Haslingden ,, ,,	26	161,726	14,002
Heywood ,, ,,	44	1,145,300	6,890
Hyde ,, ,,	13	863,958	11,028
Lancaster ,, ,,	4	33,484	798
Leigh ,, ,,	28	2,664,094	8,098
Littleborough ,,	7	133,804	6,033
Manchester and Salford . .	135	3,690,936	23,562
Middleton and district . . .	20	1,252,458	2,193
Mossley and district	17	1,387,469	834
Nelson ,, ,,	134	—	61,325
Oldham ,, ,,	245	17,286,492	16,792
Padiham ,, ,,	19	136,032	15,297
Preston ,, ,,	87	2,183,130	72,059
Radcliffe ,, ,,	48	259,892	12,190
Ramsbottom ,,	27	95,592	10,038
Carried forward	1,706	49,508,219	727,283

—	Number of Firms.	Number of Spinning Spindles.	Number of Looms.
Brought forward	1,706	49,508,219	727,283
Rawtenstall and district	22	310,344	9,831
Rochdale ,, ,,	114	3,671,322	20,229
Stalybridge ,, ,,	19	1,199,606	6,742
Stockport ,, ,,	67	2,308,160	9,787
Todmorden ,, ,,	42	399,296	17,940
Uppermill ,, ,,	6	109,800	—
Warrington ,, ,,	3	70,000	2,400
Waterfoot ,, ,,	7	47,910	2,004
Wigan ,, ,,	18	1,115,652	11,527
Total .	2,004	58,740,309	807,743

The total number of doubling spindles is 2,233,072. Doubling is the process of forming a sliver from two or more smaller slivers to produce a uniform roving.

APPENDIX III

THE COTTON TRADE IN WAR TIME

THE cotton trade, for the first time in its history, was temporarily (August, 1917) controlled by a Government department—the Board of Trade—and in order successfully to deal with all the technicalities and ramifications of the industry, the Government wisely set up a Board of Control, composed for the most part of representatives of cotton employers, operatives, importers and distributors.

The industry was threatened with a famine in American cotton in the third year of the war, in consequence of the severe restrictions placed on shipping and also because of the submarine menace, and the price per bale rapidly advanced from £25 per bale to nearly double that amount. The stocks at Liverpool in June (1917) were only sufficient to keep the mills running a few weeks at the then rate of consumption, and it was in order to check speculation and to secure that the available stocks of cotton should be more equally distributed and not allowed to fall below a certain level that Government assistance was sought. A deputation from the Liverpool Exchange and another deputa-

tion representing the spinning and manufacturing interests went to London, and in conference with Sir Albert Stanley, the President of the Board of Trade, they explained how near was the danger of industrial collapse failing drastic regulations which only the Government could impose. The position summarised was that the stock of American cotton at Liverpool and in the mills was, approximately, 700,000 bales. The normal weekly consumption was 62,000 bales, the actual weekly consumption was not less than 50,000 bales, whilst the weekly import was at the rate of 21,000 bales.

If the cotton were all of one sort and could be distributed in the right proportion this should mean a supply for something like twenty weeks, but in practice it would not work out like that. It is understood, too, that the above figures included cotton in process of manufacture. If the figures did include "clothing the mills," then the figures did not adequately represent the seriousness of the situation.

A month later it was reported that the quantity of cotton afloat for Great Britain totalled 97,000 bales against 206,000 in 1916, and that the American amounted to 57,000 against 173,000 in 1916.

The Government did intervene in the first instance by stopping the speculation in cotton on the Liverpool market, and later by controlling, through

the Cotton Control Board, the raw cotton. The regulations for trading in the Liverpool cotton "futures" market were as follows :—

1. Trading in "futures" to be confined to—

(a) Buying by spinners in the United Kingdom to cover sales of yarn and buying by importers against sales of actual cotton to spinners in the United Kingdom.

(b) Selling of "hedges" by importers and spinners against purchases of actual cotton, for shipment to, or in, the United Kingdom.

(c) Liquidation of open contracts. As regards open contracts, no transfer of these to any other position can be made except in the case of "hedges" by importers against actual cotton shipped to the United Kingdom, and in the case of purchases by spinners in the United Kingdom against sales of yarn.

NOTE.—From the above it will be seen that no "straddles" or speculative business can be transacted by or for members, or on account of clients.

2. Prices of "futures" to be advanced or reduced from time to time by a committee, who will use as their basis the prices prevailing in the Southern States of America for American "futures," and in Alexandria for Egyptian "futures." The Committee, however, to have discretion to fix a lower price than would be indicated by this basis.

The differences between all months to remain as fixed. No tenders will be allowed until further notice.

NOTE.—Some of these restrictions have since been removed.

The next step taken by the Government was to give the necessary authority to the new Board of Control by issuing an order of which the operative clauses are as follows :—

1. A person shall not without a licence (general or special) granted by or under the authority of the Board of Trade, nor otherwise than in accordance with the conditions, if any, subject to which such a licence is granted, purchase any raw cotton, and a person shall not sell or offer to sell raw cotton to any person except the holder of such a licence, nor to the holder of such a licence otherwise than in accordance with such conditions as aforesaid.

The conditions imposed by the Board of Trade may include conditions as to maximum price, provided that any price so fixed shall not apply to the sale of any particular parcel of raw cotton by a person who had previously entered into a contract for the purchase thereof, so as to reduce the selling price of that parcel below the cost incurred by that person in purchasing the cotton and bringing it to the United Kingdom, together with such margin to cover incidental expenses and profit as the Board of Trade may think reasonable.

2. All importers and dealers in raw cotton and cotton spinners shall comply with any general or special directions which may be given by or under the authority of the Board of Trade as to the sale, disposal, delivery, or use of raw cotton.

3. Infringements of this order are summary offences, subject to penalties under the Defence of the Realm Regulations.

The Cotton (Restriction of Output) Order, 1917, is dated August 9, and was made by the Board of Trade pursuant to regulations 2F, 2GG and 2JJ of the Defence of the Realm Regulations. This Order reads :—

WHEREAS the Board of Trade deem it expedient to make further exercise of the power vested in them by the Defence of the Realm Regulations as respects cotton including Cotton Waste.

NOW THEREFORE the Board of Trade in exercise of their said powers and of all other powers them enabling do hereby order as follows :—

1. The Cotton Control Board may from time to time, by notice exhibited in the Manchester Royal Exchange, and advertised in such other manner as they think fit, give instructions as to the number or percentage of spindles or looms that may be worked in any cotton mill or weaving shed as from the date or dates specified in the notice, and may cancel or vary such instructions as occasion may require by similar notice.

2. The Cotton Control Board may grant licences enabling a greater number of percentage of spindles or looms to be worked than that authorised by such

instructions upon such terms and subject to such conditions as may be specified in the notice.

3. Where restrictions are placed upon the number or percentage of spindles that may be worked such restrictions shall be deemed to affect any preparatory machinery worked in connection therewith.

4. All persons shall obey any instructions that may be issued by the Cotton Control Board under this Order.

5. If any person acts in any manner contrary to the instructions issued by the Cotton Control Board under this Order he is guilty of an offence under the Defence of the Realm Regulations.

Signed on behalf of the Board of Trade,

H. Llewellyn Smith,

Secretary.

Board of Trade,
7, Whitehall Gardens, S.W. 1.

The Cotton Control Board, over which Sir Herbert Dixon, Bart. (Chairman of the Fine Cotton Spinners' Association), presides, immediately took control of the stocks of cotton and made enquiries as to the stocks of cotton at the mills and in the warehouses. Upon the information thus obtained the Board formulated a scheme intended to distribute as equally and fairly as possible the inevitable burdens upon all sections of the industry. This scheme came into force on Monday, September 10, 1917, for a period of three months. It has since been agreed to extend its working to June, 1918. It is

hoped that at the end of this time normal work may be resumed since the Shipping Controller promised to increase the tonnage available for cotton.

Appended is the full text of the scheme :—

THE COTTON CONTROL BOARD.

THE COTTON (RESTRICTION OF OUTPUT) ORDER, 1917.

INSTRUCTIONS.

Issued by the Cotton Control Board Pursuant to the above Order.

1. Subject to the provisions of paragraph 7 hereof, on and after the 3rd September, 1917, no person shall work or allow to be worked in any cotton or cotton waste mill occupied by him, more than 60 per cent. of the total number of mule and/or ring spindles, and necessary preparatory machinery, contained therein without a licence from the Cotton Control Board.

2. Licences may be granted by the Cotton Control Board to spinners of Egyptian and Sea Island Cotton and to spinners of cotton waste to work more than 60 per cent. of the total number of mule and/or ring spindles and necessary preparatory machinery in any mill during such time as may be prescribed by the licence, on payment of—

$1\frac{1}{4}d.$ per mule spindle per week, and
$1\frac{7}{8}d.$ per ring spindle per week.

on all spindles worked above 60 per cent, of the total number.

EXAMPLE :—

A mule spinning mill containing 100,000 spindles,

60,000 spindles may be worked without any payment.

63,000 may be worked on payment of a weekly levy of $1\frac{1}{4}d.$ per spindle on the extra 3,000 spindles, and so on.

3. Licences may be granted by the Cotton Control Board to spinners of American and all growths of cotton, other than Egyptian and Sea Island, to work up to 70 per cent. of their total number of mule and/or ring spindles during such time as may be prescribed by the licence, on payment of $1\frac{1}{4}d.$ per mule spindle, and $1\frac{7}{8}d.$ per ring spindle per week on the spindles in excess of 60 per cent. of the total spindles in the mill. Provided that where a spinner of any such cotton proves to the satisfaction of the Board that he is engaged on a Government contract or contracts, a licence to work spindles in excess of 70 per cent. may be granted, on payment of the weekly levies mentioned in the last paragraph.

4. Where a mill contains both ring and mule spindles the occupier shall before the 3rd day of September, 1917, apply to the Cotton Control Board for directions as to the proportion of ring and mule spindles respectively that may be worked, and the Board shall give such directions as they think fit, provided that they shall allow 60 per cent. of the total of such spindles to be worked.

5. Subject to the provisions of paragraph 7 hereof, on and after the 3rd September, 1917, no person shall work or allow to be worked more than 60 per cent. of the total number of looms in any weaving shed occupied by him, without a licence from the Cotton Control Board, provided that any beams actually in looms at

the date of these instructions may be woven out within four weeks of the date hereof.

EXAMPLE :—

A manufacturer has 100 looms all working. He may on and after September 3rd run 60 looms without payment of levy, and is allowed four weeks from August 22nd in which to weave out the remaining 40 looms. Should he intend, however, to keep running, say, 80 looms, he must declare this number now, and pay the levy, as shown in Clause 6, on the extra 20 looms from September 3rd, the remaining 20 looms being allowed four weeks from August 22nd in which to weave out.

6. Licences may be granted by the Cotton Control Board to work during such time as may be prescribed by the licence extra looms upon payment of 2*s.* 6*d.* per week for each loom up to 72 inch reed space, and 5*s.* or each loom over 72 inch reed space worked in excess of 60 per cent. of the total number.

7. Where two or more mills or two or more weaving sheds are occupied by the same person the Cotton Control Board may direct the number of mule and/or ring spindles or looms that may be worked in each separate mill or weaving shed occupied by the same person, so that the total number worked by any one person without a licence shall not exceed 60 per cent. of the total number contained in his mills or weaving sheds.

8. All applications for licences shall be made upon a form to be obtained from the Cotton Control Board, and must reach the Board not later than the Wednesday morning in the week preceding the week during which the licence is to commence.

9. No person shall make any false statement or representation for the purpose of obtaining a licence.

10. The expression "person" includes a firm or other association of persons, and a company.

The expression "mill" includes any place where yarn or waste is spun.

The expression "weaving shed" includes any place where looms are worked.

For the Cotton Control Board,
H. D. HENDERSON,
Secretary.

August 22nd, 1917.

[NOTE.—The operation of the scheme was postponed by the Cotton Control Board until September 10 in consequence of the closing of many mills for the holidays in the week beginning September 3.]

The intention of the Board was to reduce the consumption of cotton to 40 per cent. below pre-war consumption except in so far as further consumption is allowed under licence.

The following suggestions applying to spinning mills were adopted at a representative conference of employers and operatives :

1. Where possible all machines should be fully and efficiently staffed and preference should be given to older men and to heads of families. As a general rule the services of the latest comers should be dispensed with first.

2. Where, after fully and efficiently staffing the 60 per cent. or other percentage of machinery, there

is still a surplus of labour there might then be set up a system of rotation of workpeople. This applies to mule spinning rooms.

3. Local committees will be set up to deal with the questions arising out of the displacement of labour, and where employers' or operatives' committees already exist they will be utilised.

NOTE.—The scheme affects 2,000 firms with 58,740,000 spinning spindles and 807,543 looms.

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